The Atomists: Leucippus and Democritus

Fragments

A TEXT AND TRANSLATION
WITH A COMMENTARY BY
C.C.W. TAYLOR

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PHOENIX

Journal of the Classical Association of Canada
Revue de la Société canadienne des études classiques
Supplementary Volume XXXVI / *Phoenix* Presocratics Volume V
Tome supplémentaire XXXVI / Les Présocratiques *Phoenix* tome V

Phoenix Presocratics / Les Présocratiques *Phoenix*
General Editors / Rédacteurs en chef
David Gallop *Trent University*
T.M. Robinson *University of Toronto*

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UNIVERSITY OF TORONTO PRESS

Toronto Buffalo London

www.utppublishing.com

© University of Toronto Press Incorporated 1999

Toronto Buffalo London
Printed in Canada

ISBN 0-8020-4390-9

Printed on acid-free paper

Canadian Cataloguing in Publication Data

Leucippus
The atomists, Leucippus and Democritus : fragments : a text and translation with a commentary

(Phoenix Presocratics ; v. 5 = Les Présocratiques Phoenix ; t. 5)
(Phoenix. Supplementary volume ; 36 = Phoenix.
Tome supplémentaire, 0079-1784 ; 36)
Greek text with English translation and commentary.
Includes bibliographical references and index.
ISBN 0-8020-4390-9

1. Physics – Philosophy – Early works to 1800. 2. Atomism – Early works to 1800. 3. Philosophy, Ancient. I. Democritus. II. Taylor, C.C.W. (Christopher Charles Whiston), 1936– . III. Title. IV. Series: Phoenix pre-Socratics (Toronto, Ont.) ; v. 5. V. Series: Phoenix. Supplementary volume (Toronto, Ont.) ; 36.

B225.E5T39 1999 182'.5 C98-932682-9

University of Toronto Press acknowledges the financial assistance to its publishing program of the Canada Council for the Arts and the Ontario Arts Council.

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ACKNOWLEDGMENTS

My principal debt is to the General Editors of the Phoenix Presocratics series, both for their invitation to contribute this volume and for the patience and helpfulness with which they have assisted its excessively prolonged gestation. I hope that the outcome will adequately recompense their kindness.

Of the numerous friends and colleagues who have have helped me with comments and criticism I should like particularly to mention Nicholas Denyer, Gail Fine, David Furley, Tony Long, and David Sedley. Part of the commentary was read to the Cambridge 'B' Club in the spring of 1996; I am particularly grateful for the incisive comments which it received. I am also indebted to two anonymous referees for their helpful suggestions.

Portions of the commentary were previously published in the chapter 'Anaxagoras and the Atomists' which I contributed to *Routledge History of Philosophy, vol. 1*, ed. C.C.W. Taylor (London, Routledge: 1997). I am grateful to the publishers for permission to reproduce this material.

I am grateful to Oxford University for the award of a special lecturership in 1993–4, and to my college for sabbatical leave in Hilary Term 1996. Without the relief from teaching duties thus provided the appearance of this volume would have been even further delayed.

C.C.W. TAYLOR

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1998

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ABBREVIATIONS

CAG	*Commentaria in Aristotelem Graeca*
CIG	*Corpus Inscriptionum Graecarum*
CPF	*Corpus dei papiri filosofici greci e latini*, Florence, 1989–95
CQ	*Classical Quarterly*
CSEL	*Corpus Scriptorum Ecclesiasticorum Latinorum*
DK	H. Diels and W. Kranz, *Die Fragmente der Vorsokratiker*, 6th ed., Berlin, 1951
Dox.	H. Diels, *Doxographi Graeci*, Berlin 1879, repr. 1965
LS	A.A. Long and D.N. Sedley, *The Hellenistic Philosophers*, Cambridge, 1987
LSJ	Liddell and Scott, *Greek-English Lexicon*, 9th ed., revised H.S. Jones and R. McKenzie, Oxford, 1940
RE	Pauly-Wissowa, *Realencyclopädie der classischen Altertumswissenschaft*, Stuttgart, 1874–

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PREFACE

The aim of this work is to present the ancient evidence, both direct and indirect, for the thought of Leucippus and Democritus, and to assist the critical evaluation of the thought of those philosophers by the provision of a commentary on the evidence. In accordance with the format of the series to which it belongs, a Greek text of the fragments is provided, accompanied by facing translation, whereas the testimonia are given in translation only. The policy which has determined the selection of fragments is explained in the commentary at the beginning of the section on Ethics and Politics (pp. 222–7).

As explained in the commentary, the evidence for the atomists presents the peculiar feature that, while the number of purported fragments is large, very few fragments deal with the atomists' central doctrines, for which we are almost wholly reliant on doxographical evidence. Consequently the commentary, with the exception of the section on Ethics and Politics, is almost exclusively confined to the testimonia. The following points about the presentation of the latter in this volume should particularly be noted.

1. Though I have presented the biographical evidence, such as it is, for Leucippus separately from that for Democritus, I do not make any distinction between the two in respect of doctrines. That policy seems to me to be sanctioned by the doxographical tradition (see commentary, 'Life and Works,' pp. 157–8).

2. While the biographical section of the testimonia closely follows the order of DK, the various sections on the doctrines of the atomists are not based on any selection previously published. Of the selections available, DK is unsatisfactory for two reasons. First, it omits many important passages (see Concordance A); second, its separation of Leucippus from Democritus results in the arbitrary dislocation of unitary passages of evidence. While

Luria includes virtually everything, he frequently carves up continuous passages into disconnected fragments, often less than a complete sentence, many of which are printed several times in the light of their relevance to different topics. It therefore seemed to me better to start afresh by making my own selection of passages and ordering them as seemed to me best to exhibit the structure of the atomists' doctrines. Where the atomists are mentioned in the context of a continuous argument, as is frequently the case in Aristotle, I have tried, as far as limitations of space permit, to present sufficient of the context to make the direction of the argument intelligible.

3. I have not attempted to include every passage in ancient literature in which the atomists are referred to. Not only would that have made the volume unacceptably large, but it would not have served the purpose of the work, since it would merely have encumbered the reader with a plethora of passages repeating essentially the same information. I have translated what I judge to be enough passages to provide the essential evidence, and have added further references to guide the reader who wishes to research further the doxographical tradition on particular points. These further references are designated by the number of the testimonium to which they are appended, followed by 'cit' (for citation) and (where more than one passage is cited) a lower-case roman numeral indicating the order of the passage in the list of citations. E.g., '21cit i' designates the first additional passage cited under testimonium 21.

I append to the commentary a concordance to allow the reader to cross-refer from this volume to the two other principal collections of evidence, those of DK and Luria, and brief notes on the sources cited.

Fragments are designated by a number preceded by **L** (for Leucippus) or **D** (for Democritus); testimonia are designated by number only. Items in the bibliography are numbered consecutively, and are designated by the author's surname followed by the number, e.g. Barnes 7.

Author's comments or elucidations in the translations are enclosed in square brackets.

I have tried to make the volume accessible to readers who know no Greek. Inevitably, this aim in attainable only in part, since many of the sources cited are not available in translation, and it is not practicable to provide translations for all of them. All translations used in the volume are my own.

THE ATOMISTS: LEUCIPPUS AND DEMOCRITUS

FRAGMENTS: TEXT

LEUCIPPUS

L1. *οὐδέν χρῆμα μάτην γίνεται, ἀλλὰ πάντα ἐκ λόγου τε καὶ ὑπ' ἀνάγκης.*
STOBAEUS I.4.7c [= AETIUS I.25.4]

DEMOCRITUS

LIFE

D1. *ἦλθον γάρ εἰς Ἀθήνας καὶ οὔτις με ἔγνωκεν.*
DIOGENES LAERTIUS IX.36

GENERAL

D2. *Δημόκριτος γοῦν αὐτός, ὥς φασιν, ἔλεγε βούλεσθαι μίαν εὑρεῖν αἰτιολογίαν ἢ τὴν Περσῶν οἱ βασιλείαν γενέσθαι.*
DIONYSIUS ap. EUSEBIUS *PE* XIV.27.4

D3. *νέα ἐφ' ἡμέρῃ φρονέοντες*
PLUTARCH *Mor.* 655d, 722d, 1129e.

FRAGMENTS: TRANSLATION

LEUCIPPUS

L1. From *On Mind*
Nothing happens in vain, but everything from reason and by necessity.[1]
STOBAEUS I.4.7c [= AETIUS I.25.4]. Context in **74d**.

DEMOCRITUS

LIFE

D1. For I came to Athens and no one knew me.
DIOGENES LAERTIUS IX.36. Context in **6** (36). Also in CICERO, *Tusculan Disputations* V.36.104.

GENERAL

D2. Democritus himself, so they say, said that he would rather discover a single explanation than acquire the kingdom of the Persians.
EUSEBIUS *Praeparatio Evangelica* XIV.27.4 [citing DIONYSIUS of Alexandria]

D3. Thinking new things every day.
PLUTARCH attributes this proverbial-type expression to Democritus three times: *Convivial Questions* III.6.4, 655d; VIII.3.5, 722d; *On the Maxim 'Live out of the public eye'* 5, 1129e.

1 For the translation of *matēn* and for the interpretation of the fragment see commentary 'Chance and Necessity,' pp. 188–90

WORKS ON NATURE

D4. *λέγων τάδε περὶ τῶν ξυμπάντων*
SEXTUS *M.* VII.265
[Sextus changes the verb from present indicative to present participle to fit the construction of his own sentence. Cicero (see opp.) indicates that Democritus' own words were probably *τάδε λέγω* ...]

D5. *ἄνθρωπός ἐστιν ὃ πάντες ἴδμεν.*
SEXTUS ibid.

D6. *καὶ γάρ ζῷα ὁμογενέσι ζώοις συναγελάζεται, ὡς περιστεραὶ περιστεραῖς καὶ γέρανοι γεράνοις, καὶ ἐπὶ τὸν ἄλλων ἀλόγων· ὡσαύτως δὲ καὶ ἐπὶ τῶν ἀψύχων, καθάπερ ὁρᾶν πάρεστιν ἐπί τε τῶν κεκοσκινουμένων σπερμάτων καὶ ἐπὶ τῶν παρὰ ταῖς κυματωγαῖς ψηφίδων· ὅπου μὲν γὰρ κατὰ τὸν τοῦ κοσκίνου δῖνον διακριτικῶς φακοὶ μετὰ φακῶν τάσσονται καὶ κριθαὶ μετὰ κριθῶν καὶ πυροὶ μετὰ πυρῶν, ὅπου δὲ κατὰ τὴν τοῦ κύματος κίνησιν αἱ μὲν ἐπιμήκεις ψηφῖδες εἰς τὸν αὐτὸν τόπον ταῖς ἐπιμήκεσιν ὠθοῦνται, αἱ δὲ περιφερεῖς ταῖς περεφερέσιν, ὡς ἂν συναγωγόν τι ἐχούσης τῶν πραγμάτων τῆς ἐν τοῦτοις ὁμοιότητος.*
SEXTUS *M.* VII.117–18
[Sextus does not reproduce Democritus' Ionic dialect, but the elaboration of the sentence construction suggests at the least a close paraphrase.]

D7. *δῖνον ἀπὸ τοῦ παντὸς ἀποκριθῆναι παντοίων ἰδεῶν*
SIMPLICIUS *Phys.* 327.24–5

D8. *ξυνουσίη ἀποπληξίη σμικρή· ἐξέσσυται γὰρ ἄνθρωπος ἐξ ἀνθρώπου καὶ ἀποσπᾶται πληγῇ τινι μεριζόμενος.*
HIPPOLYTUS *Ref.* VIII.14 *ἄνθρωπος ἐξ ἀνθρώπου ἐξέσσυται καὶ ἀποσπᾶται ... μεριζόμενος*; STOBAEUS III.6.28 *ξυνουσίη ... ἀνθρώπου.*

WORKS ON NATURE

D4. This I say about everything.

D5. Man is what we all know.

SEXTUS *Against the Mathematicians* VII.265

Democritus, imitating the voice of Zeus and 'Saying this about everything,' tried to set out his conception [sc. of the nature of man], but achieved no more than the commonsense statement which he put as 'Man is what we all know.'

[Also CICERO *Academica* II.23.73

What shall I say about Democritus? ... He was bold enough to begin with 'This I say about everything.']

D6. Animals flock together with animals of the same kind, doves with doves and cranes with cranes and similarly with the other irrational creatures, and so with non-living things too, as one can see in the case of seeds in a sieve and pebbles on a beach. In the one lentils are sorted out by the swirl of the sieve to lie together with lentils, barley with barley, and wheat with wheat, and in the other oblong pebbles are pushed by the motion of the waves into the same place as oblong and round into the same place as round, as if that sort of similarity in things had a kind of attractive force.

SEXTUS *Against the Mathematicians* VII.116–18

There is an ancient opinion that like things are recognized by like. Democritus seemed to have devised some considerations in support of this opinion ... he based his argument on the behaviour of living and non-living things. For 'Animals flock together,' he says, 'with animals ... attractive force.' [Cf. **124.**]

D7. A swirl of forms of all kinds was separated off from the totality.

SIMPLICIUS *Commentary on* Physics 327.24–5. Context in **71c.**

D8. Sexual intercourse is a mild apoplexy; for man issues from man and is torn away, separated by a sort of blow.

This saying is preserved in two senses, as follows:

HIPPOLYTUS *Refutation of All Heresies* VIII.14

Man issues ... blow.

STOBAEUS III.6.28

Sexual intercourse ... from man.

μικρὰν ἐπιληψίαν τὴν συνουσίαν ὁ Ἀβδηρίτης ἔλεγεν σοφιστής ... ἄνθρωπος γὰρ ἐξ ἀνθρώπου ἐκφύεται καὶ ἀποσπᾶται.
CLEMENT *Paed.* II.94

D9. *ἄνθρωποι εἷς ἔσται καὶ ἄνθρωπος πάντες.*
Diels suggests *ἄνθρωπος ἐξέσσυται ἐξ ἀνθρώπου παντός.*
Ps-GALEN *Def. Med.* 439 (XIX.449 K.)

D10. *ξυόμενοι ἄνθρωποι ἥδονται καὶ σφιν γίνεται ἅπερ τοῖς ἀφροδισιάζουσιν.*
HERODIAN ap. EUSTATHIUS in *Od.* XIV.428

D11. *Διόβλητον μὲν οὐδὲν ... παρ' αἰθρίης στέγειν ... σέλας.*
Pohlenz *οὐδὲν <γήινον οἷον τὸ> παρ' ...*; Diels *οὐδέν <οἷον μὴ τὸ>*: Diels *στέγειν <εὐαγές>*
PLUTARCH *Mor.* 665f

An alternative version is that of CLEMENT *Paedagogus* II.94

The sage of Abdera called intercourse 'mild epilepsy' ... for man grows out of and is torn away from man.

[It is uncertain whether Democritus himself used the terms 'apoplexy' and 'epilepsy' or whether either term or both paraphrase his own terminology.

Cf. GALEN Commentary on Hippocratic *Epidemics* XVII A.521; id. XVII B.28; GALEN *Is the Foetus an Animal?* XIX.176; PLINY *Natural History* XXVIII.16.58.]

D9. One will be men and man all.

Ps-GALEN *On Medical Definitions* 439 (XIX.449)

Democritus and Hippocrates say that the sperm is secreted by the whole body:[2] Democritus says 'One ... all.'

[The sentence reported by ps-Galen is unclear in sense, and does not seem capable of expressing the sense required by the context. Hence Diels suggests that the words are a corruption of another version of **D8**, with the sense 'Man issues from the whole man.'

SENECA *Letters* 7.10 [= DK 68 B302a] records a saying of Democritus on the theme of the importance of the individual: 'Unus mihi pro populo est, et populus pro uno' (To my mind one man is worth as much as the people, and the people is worth as much as one). The structural resemblance to the unintelligible sentence recorded by ps-Galen is striking, and it is possible that that sentence is a garbled version of an ethical maxim (recorded by Seneca) which was introduced into the biological context by an unintelligent copyist, through confusion with a version of **D8**.]

D10. When people scratch themselves they experience pleasure like that of sex.

EUSTATHIUS Commentary on *Odyssey* XIV.428 [citing HERODIAN, a grammarian of the second century AD]

D11. Nothing struck by lightning <can> contain the flash from heaven.

PLUTARCH *Convivial Questions* IV.2.4, 665f

[The mss. have gaps after 'lightning' and before 'flash.' Editorial restorations give conflicting senses: Pohlenz restores to read 'No earthly thing struck by lightning can contain [i.e. withstand] the bright flash from heaven,' Diels 'No lightning sent from Zeus does not preserve the pure brightness of the heavens.' The context, which deals with the different effects of lightning-strikes on different kinds of things, indicates that the sense of Democritus' statement is that suggested by Pohlenz.]

2 See **135**, with commentary 'Science and Mathematics,' pp. 198–9

LITERARY CRITICISM AND THEORY OF LANGUAGE

D12. *ποιητὴς δὲ ἄσσα μὲν ἂν γράφῃ μετ' ἐνθουσιασμοῦ καὶ ἱεροῦ πνεύματος, καλὰ κάρτα ἐστίν.*
CLEMENT *Strom.* VI.168

D13. *Ὅμηρος φύσεως λαχὼν θεαζούσης ἐπέων κόσμον ἐτεκτήνατο παντοίων.*
DIO CHRYS. 36.1

THEOLOGY

D14. *τῶν λογίων ἀνθρώπων ὀλίγοι ἀνατείναντες τὰς χεῖρας ἐνταῦθα, ὃν νῦν ἠέρα καλέομεν οἱ Ἕλληνες 'πάντα, <εἶπαν>, Ζεὺς μυθέεται καὶ πάνθ' οὗτος οἶδε καὶ διδοῖ καὶ ἀφαιρέεται καὶ βασιλεὺς οὗτος τῶν πάντων.'*
Reinhardt <εἶπαν>
CLEMENT *Protr.* 68.5 *ὁ Δ. τῶν λογίων ἀνθρῶπων ὀλίγους φησὶν ἀνατείναντας ... πάντα διαμυθεῖσθαι* [Heinse *Δία μυθεῖσθαι*] ...
CLEMENT *Strom.* V.102 *ὀλίγους γράφει τῶν ἀνθρώπων οἳ δὴ ἀνατείνοντες* [EUSEBIUS *PE* XIII.13.27 *ἀνατείναντες*] ...

EPISTEMOLOGY

D15. *ἐτεῇ δὲ οὐδέν ἴδμεν· ἐν βυθῷ γάρ ἡ ἀλήθεια.*
Stephanus *ἐτεῇ*: mss. *αἰτίη*.
DIOGENES LAERTIUS IX.72

D16. *νόμῳ γλυκὺ καὶ νόμῳ πικρόν, νόμῳ θερμόν, νόμῳ ψυχρόν, νόμῳ χροιή· ἐτεῇ δὲ ἄτομα καὶ κενόν.*
SEXTUS *M.* VII.135

LITERARY CRITICISM AND THEORY OF LANGUAGE

D12. What a poet writes with inspiration and the breath of the gods is very fine.
CLEMENT *Miscellanies* VI.168. Context in **166c**.

D13. Homer, by getting a share in the divine nature, accomplished the ordering of all kinds of verses.
DIO CHRYSOSTOM 36.1. Context in **166d.**

THEOLOGY

D14. A few learned people, raising their hands towards what we Greeks now call the air, said 'Zeus thinks of all things and he knows all things and gives and takes away, and he is king of all things.'
CLEMENT *Protrepticus* 68.5

Democritus says that a few learned people ... king of all things.'
CLEMENT *Miscellanies* V.102

Democritus writes that there were a few people who, raising their hands ... king of all things.'

EPISTEMOLOGY

D15. In reality we know nothing; for truth is in the depths.
DIOGENES LAERTIUS IX.72. Context in **179b**.

D16. By convention sweet and by convention bitter, by convention hot, by convention cold, by convention colour; but in reality atoms and void.[3]
SEXTUS *Against the Mathematicians* VII.135. Also DIOGENES LAERTIUS IX.72; GALEN *On Medical Experience* 15.7; GALEN *On the Elements according to Hippocrates* I.2. Contexts in **179a–d**. See also **206**.

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3 Democritus here characterizes the contrast between how things appear to the senses and how they are in reality in terms of the distinction between convention (*nomos*) and nature (normally *phusis*, for which he substitutes the term *eteē*, reality or truth, a word which Galen (**179d**) indicates was a coinage of his own). The contrast was widely applied in fifth-century thought; for discussion of its application to moral and political questions see commentary 'Ethics and Politics,' pp. 229–30, and for a full discussion see W.K.C. Guthrie, *A History of Greek Philosophy* vol. 3 (Cambridge, 1969), ch. 4. There are

D17. *ἡμεῖς δὲ τῷ μὲν ἐόντι οὐδὲν ἀτρεκὲς συνίεμεν, μεταπῖπτον δὲ κατά τε σώματος διαθήκην καὶ τῶν ἐπεισιόντων καὶ τῶν ἀντιστηριζόντων.*
SEXTUS *M.* VII.136

D18. *ἐτεῇ μέν νυν ὅτι οἷον ἕκαστον ἔστιν ἢ οὐκ ἔστιν οὐ συνίεμεν, πολλαχῇ δεδήλωται.*
SEXTUS *M.* VII.136

D19. *γιγνώσκειν τε χρὴ ἄνθρωπον τῷδε τῷ κανόνι ὅτι ἐτεῆς ἀπήλλακται.*
SEXTUS *M.* VII.137

D20. *δηλοῖ μὲν δὴ καὶ οὗτος ὁ λόγος ὅτι ἐτεῇ οὐδὲν ἴσμεν περὶ οὐδενός, ἀλλ' ἐπιρυσμίη ἑκάστοισιν ἡ δόξις.*
SEXTUS *M.* VII.137

D21. *καίτοι δῆλον ἔσται ὅτι ἐτεῇ οἷον ἕκαστον γιγνώσκειν ἐν ἀπόρῳ ἐστί.*
SEXTUS *M.* VII.137

D17. In fact we know nothing firm, but what changes according to the condition of the body and of the things that enter it and come up against it.
SEXTUS *Against the Mathematicians* VII.136. Context in **179a**.

D18. That in reality we do not know what kind of thing each thing is or is not has been shown many times.
SEXTUS *Against the Mathematicians* VII.136. Context in **179a**.

D19. By this principle man must know that he is removed from reality.
SEXTUS *Against the Mathematicians* VII.137. Context in **179a**.

D20. This argument too shows that in reality we know nothing about anything, but each person's opinion is something which flows in.[4]
SEXTUS *Against the Mathematicians* VII.137. Context in **179a**.

D21. Yet it will be clear that to know what kind of thing each thing is in reality is impossible.
SEXTUS *Against the Mathematicians* VII.137. Context in **179a**.

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in fact two contrasts, since what is the case in reality or in the nature of things, independently of human choice or agreement, may be opposed either to (i) things which are in fact *F*, but only because human beings have decided or agreed that they are to be regarded as *F* (e.g., being socially acceptable), or to (ii) things which are not in fact *F*, but are merely called *F* (e.g., what is really separation of elements is *called* destruction, Empedocles fr. 9 DK). To the extent that it is disputable how far anything actually becomes *F* by being generally regarded as, or by being regularly called, *F*, these two contrasts shade into one another. That seems to be so in this case, since Democritus might be taken as saying either that things do have secondary qualities only because people agree that they have them (since that is how they seem), or that they do not in fact have those qualities, but people agree to say that they do (since that is how they seem), or as not having distinguished the two theses. Either way, the crucial point is that the convention of using secondary quality terminology is not arbitrary, since it captures how things appear to us. See further commentary 'Secondary Qualities,' pp. 175–9.

4 Following DK, I translate *epirusmiē* as an adjective, qualifying *doxis* (opinion), having the sense 'flowing in,' from the verb *epirreō*. That is the sense of the word (which is found only in this passage) attested in the fifth century AD lexicon of Hesychius. On the other hand, *rusmos* (an Ionic form of *ruthmos*) was an atomistic technical term for 'shape' (**45**, **46a**) and one of the titles preserved in Diogenes Laertius' list of the works of Democritus (**40** (47)) is *Peri Ameipsirusmiōn* 'On Changes of Shape,' where *ameipsirusmiē* is a noun. Further, though the noun *epirusmiē* is not itself found, the verb *epirruthmizein* does occur (very rarely) in the sense of 'alter.' Most scholars (including Langerbeck 11, Guthrie 9, Luria 2, Alfieri 5, Barnes 7, and Salem 15) therefore interpret the word here as a noun, a variant for *ameipsirusmiē*, giving the sense 'opinion is a reshaping.' (de Ley 91 actually proposes amending Sextus' text to read *ameipsirusmiē*.) The point of the

D22. *γνώμης δὲ δύο εἰσὶν ἰδέαι, ἡ μὲν γνησίη ἡ δὲ σκοτίη· καὶ σκοτίης μὲν τάδε σύμπαντα, ὄψις ἀκοὴ ὀδμὴ γεῦσις ψαῦσις, ἡ δὲ γνησίη, ἀποκεκριμένη δὲ ταύτης. ὅταν ἡ σκοτίη μηκέτι δύναται μήτε ὁρῆν ἐπ' ἔλαττον μήτε ἀκούειν μήτε ὀδμᾶσθαι μήτε γεύεσθαι μήτε ἐν τῇ ψαύσει αἰσθάνεσθαι, ἀλλ' ἐπὶ λεπτότερον < >.*
< > postulated and variously supplemented by various editors. Bury (Loeb ed.) *ἄλλο τι <ληπτέον> λεπτότερον.* Sedley 95 ... *ψαῦσις. ἡ δὲ γνησίη, ἀποκεκριμένη δὲ ταύτης, ... ἀλλ' ἐπὶ λεπτότερον.* Langerbeck 11 *ἀποκεκρυμμένα δὲ <τὰ> ταύτης.*
SEXTUS *M.* VII.139

D23. *τάλαινα φρήν, παρ' ἡμέων λαβοῦσα τὰς πίστεις ἡμέας καταβάλλεις; πτῶμά τοι τὸ κατάβλημα.*
GALEN *Emp. med.* 15.7

ETHICS

Fragments Attested or Confirmed by Writers Other Than Stobaeus

D24. *εὐδαιμονίη ψυχῆς καὶ κακοδαιμονίη.*
STOBAEUS II.7.3i

D25. *εὐδαιμονίη οὐκ ἐν βοσκήμασιν οἰκεῖ, οὐδὲ ἐν χρυσῷ· ψυχὴ οἰκητήριον δαίμονος.*
STOBAEUS ibid.

D26. *ὅρος συμφορέων καὶ ἀσυμφορέων τέρψις καὶ ἀτερπίη.*
STOBAEUS III.1.46

D22. There are two forms of judgment, genuine and bastard. To the bastard form belong all these, sight, hearing, smell, taste, touch, but the other is genuine and separate from this. When the bastard form can no longer see anything smaller or hear or smell or taste or perceive by touch, but to a finer degree ...
SEXTUS *Against the Mathematicians* VII.139. Context in **179a**.

D23. Wretched mind, you get your evidence from us, and yet you overthrow us? The overthrow is a fall for you.
GALEN *On Medical Experience* 15.7. Context in **179c**.

ETHICS

Fragments Attested or Confirmed by Writers Other Than Stobaeus

D24. Blessedness and wretchedness belong to the soul.
See **D25**.

D25. Blessedness does not reside in herds or in gold; the soul is the dwelling-place of the guardian spirit.[5]
STOBAEUS II.7.3i. Context in **189**.

D26. Joy and sorrow are the distinguishing mark of things beneficial and harmful.[6]
STOBAEUS III.1.46. CLEMENT *Miscellanies* II.130 confirms 'Joy ... mark'; see **190**.

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fragment is the same on either interpretation, viz. that our opinions about the world are determined by the impact of the flow of atoms from objects around us on our receptive mechanisms. That impact, produced by the constant influx of atoms, produces constant alteration (reshaping) of those mechanisms. The alternative interpretations pick out different stages in the causal process; since the whole process is required for an account of opinion and its relation to the reality of things, nothing substantial hinges on the choice of interpretation.

5 The Greek word *eudaimonia*, translated 'blessedness,' literally means 'having a favourable guardian spirit.' Hence the message of the statement is that blessedness depends, not on one's external circumstances, but on one's state of soul. See commentary 'Ethics and Politics,' pp. 227–30.

6 Langerbeck 11, p. 65 translates the genitives as masculine 'beneficial and harmful people.'

D27. *τὸν εὐθυμεῖσθαι μέλλοντα χρὴ μὴ πολλὰ πρήσσειν, μήτε ἰδίῃ μήτε ξυνῇ, μηδὲ ἅσσ' ἂν πράσσῃ ὑπέρ τε δύναμιν αἱρεῖσθαι τὴν ἑωυτοῦ καὶ φύσιν· ἀλλὰ τοσαύτην ἔχειν φυλακήν, ὥστε καὶ τῆς τύχης ἐπιβαλλούσης καὶ ἐς τὸ πλέον ὑπηγεομένης τῷ δοκεῖν, κατατίθεσθαι, καὶ μὴ πλέω προσάπτεσθαι τῶν δυνατῶν. ἡ γάρ εὐογκίη ἀσφαλέστερον τῆς μεγαλογκίης.*
STOBAEUS IV.39.25

D28. *ἡ φύσις καὶ ἡ διδαχὴ παραπλήσιόν ἐστι. καὶ γὰρ ἡ διδαχὴ μεταρυθμίζει τὸν ἄνθρωπον, μεταρυθμοῦσα δὲ φυσιοποιεῖ.*
Stobaeus *μετὰ ῥυσμοῦ*, emended by Mullach to *μεταρρυσμοῖ* and *μεταρρυσμοῦσα*.
ms. *φύσις ποιεῖ*, corrector *φυσιοποιεῖ*; Stobaeus *φύσιν* (corrector *-ις*) *ποιεῖ*; Usener *<καὶ> φύσις ποιεῖ*
CLEMENT *Strom.* IV.151: STOBAEUS II.31.65

D29. *ἄνθρωποι τύχης εἴδωλον ἐπλάσαντο πρόφασιν ἰδίης ἀβουλίης. βαιὰ γὰρ φρονήσει τύχη μάχεται, τὰ δὲ πλεῖστα ἐν βίῳ εὐξύνετος ὀξυδερκείη κατιθύνει.*
Diels *ὀξυδερκείῃ*; mss. *ὀξυδερκεῖν*; Meineke *ὀξυδερκίῃ*
STOBAEUS II.8.16

ἄνθρωποι ... ἰδίης ἀνοίης. φύσει γὰρ γνώμη τύχῃ μάχεται· καὶ τὴν ἐχθίστην τῇ φρονήσει ταύτην αὐτὴν ἔφασαν κρατεῖν· μᾶλλον δὲ καὶ ταύτην ἄρδην ἀναιροῦντες καὶ ἀφανίζοντες ἐκείνην ἀντικαθιστᾶσιν αὐτῆς. οὐ γάρ εὐτυχῇ τὴν φρόνησιν, ἀλλ' ἐμφρονεστάτην ὑμνοῦσι τὴν τύχην.
DIONYSIUS ap. EUSEBIUS *PE* XIV.27.5

D30. *ἰατρικὴ μὲν γὰρ σώματος νόσους ἀκέεται, σοφίη δὲ ψυχὴν παθῶν ἀφαιρεῖται.*
CLEMENT *Paed.* I.6

D27. He who is going to be cheerful must not do many things, either in private or in public life, and in his choice of what he does must not exceed his own nature and capacity, but must be watchful, so that even when fortune seizes him and urges him further in his imagination, he sets it aside and does not attempt more than what is possible. For a good amount is safer than a great amount.

STOBAEUS IV.39.25.

[Also PLUTARCH *On Tranquillity of Mind* 2, 465c

The man who said that he who is going to be cheerful ... public life first of all makes cheerfulness expensive, since it is gained at the price of inactivity.

Cf. SENECA *On Tranquillity of Mind* 13.1, *On Anger* III.6.3.]

D28. Nature and teaching are similar. For teaching reshapes the man, and in reshaping makes his nature.[7]

CLEMENT *Miscellanies* IV.151

We know that things that are hard to come by are unnecessary, and that by the providence of God necessary things are easy to come by. Therefore Democritus is right to say that nature and teaching are similar, and he gives the reason succinctly: 'For teaching ... nature.'

[Also STOBAEUS II.31.65. Paraphrased by THEODORETUS *Cure for the Ills of the Greeks* IV.1.]

D29. People fashioned an image of fortune as an excuse for their own folly. For in a few cases fortune conflicts with prudence, but most things in life intelligent clear-sightedness keeps straight.

STOBAEUS II.8.16

[Also EUSEBIUS *Praeparatio Evangelica* XIV.27.5 [citing DIONYSIUS of Alexandria]

At the beginning of his precepts he [i.e., Democritus] says 'People ... their own stupidity. For by nature judgment conflicts with fortune, and this very thing, which is most hostile to intelligence, they said is in control. And utterly overthrowing and banishing intelligence they set up fortune in its place; for they do not sing the praises of intelligence as something which enjoys good fortune, but of fortune as the most intelligent of things.'

These appear to be alternative versions of a single maxim.]

D30. Medicine heals the diseases of the body, while wisdom frees the soul from passions.

CLEMENT *Paedagogus* I.6

According to Democritus medicine ... passions.

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7 See commentary 'Ethics and Politics,' p. 233

D31. λόγος ἔργου σκιή.
PLUTARCH *Mor.* 9f

D32. ἐξ ἑαυτοῦ τὰς τέρψιας ἐθιζόμενον λαμβάνειν
PLUTARCH *Mor.* 81a

D33. ποικίλον τι καὶ πολυπαθὲς κακῶν ταμιεῖον καὶ θησαύρισμα
PLUTARCH *Mor.* 500d

D34. εἰ τοῦ σώματος αὐτῇ δίκην λαχόντος, παρὰ πάντα τὸν βίον ὧν ὠδύνηται καὶ κακῶς πέπονθεν, αὐτὸς γένοιτο τοῦ ἐγκλήματος δικαστής, ἡδέως ἂν καταψηφίσασθαι τῆς ψυχῆς, ἐφ' οἷς τὰ μὲν ἀπώλεσε τοῦ σώματος ταῖς ἀμελείαις καὶ ἐξέλυσε ταῖς μέθαις, τὰ δὲ κατέφθειρε καὶ διέσπασε ταῖς φιληδονίαις, ὥσπερ ὀργάνου τινὸς ἢ σκεύους κακῶς ἔχοντος τὸν χρώμενον ἀφειδῶς αἰτιασάμενος.
PLUTARCH *fragm. de libid. et aegr.* 2

D35. ὅσα τις ἂν νώσαιτο κακά
PHILODEMUS *De ira* XXIX.17–29

D31. The word is the shadow of the deed.
PLUTARCH *On the Upbringing of Children* 14, 9f

And we ought to discourage our sons from using bad language; for 'The word is the shadow of the deed,' as Democritus says.
[Also DIOGENES LAERTIUS IX.37 [= **6** (37)]].

D32. Accustomed to derive his joys from himself.
PLUTARCH *On Progress in Virtue* 10, 81a

[The self-controlled person] shows that reason is already growing and rooted in him, and that he is, as Democritus says, 'Accustomed ... himself.'

D33. A varied store and treasury of all sorts of evil passions.
PLUTARCH *Are the Affections of the Soul Worse than Those of the Body?* 2, 500d

If you open up your inner self you will find 'a varied store ... passions,' as Democritus says, which do not come in from outside, but have as it were their native and original sources there.

D34. If the body brought a suit against it [i.e., the soul] for all the sufferings and ills it had endured throughout its whole life, and one had oneself to judge the case, one would gladly condemn the soul for having ruined certain features of the body through carelessness and made it soft through drink and brought it to rack and ruin through love of pleasure, just as if a tool or a utensil were in a bad state one would blame the person who used it carelessly.
PLUTARCH *Do Desire and Distress Belong to the Body or the Soul?* 2

Democritus, attributing wretchedness to the soul, says 'If the body ... carelessly.' Theophrastus, in contrast, says that the soul inhabits the body at great cost. For a brief period it pays heavy fees: feelings of grief, fright, desire, jealousy. Since it encounters these feelings in the body, the soul might more justly bring suit against the body for mutilation with regard to the things it has forgotten, and for acts of violence, with regard to the way in which it is held down, and for outrage, with regard to things it suffers through contempt and abuse, being blamed quite unfairly for the evils of the body.
[Cf. PLUTARCH *Precepts for Health* 24, 135e.]

D35. As many evils as one could conceive of.
PHILODEMUS *On Anger* Herculaneum papyrus 182, column XXIX.17–29

And often many disasters come upon friends and other relatives, and sometimes on countries and kingdoms, not just long ago when that wrath [i.e., of Achilles] 'Wrought countless woes for the Greeks' but every day. And more or less 'As many evils as one could conceive of,' as Democritus says, all come about through immoderate fits of anger.

Ethical Sayings from the Collection of Stobaeus

D36. *μὴ πάντα ἐπίστασθαι προθυμέο, μὴ πάντων ἀμαθὴς γένῃ.*
II.1.12

II.4.12 [= Democrates 51]

II.7.3 [= **D24** and **D25**]

II.8.16 [= **D29**]

D37. *ἀφ' ὧν ἡμῖν τἀγαθὰ γίγνεται, ἀπὸ τῶν αὐτῶν τοῦτων καὶ τὰ κακὰ ἐπαυρισκοίμεθ' ἄν, τῶν δὲ κακῶν ἐκτὸς εἴημεν. αὐτίκα ὕδωρ βαθὺ εἰς πολλὰ χρήσιμον καὶ δαὖτε κακόν· κίνδυνος γὰρ ἀποπνιγῆναι. μηχανὴ οὖν εὑρέθη, νήχεσθαι διδάσκειν.*
II.9.1

D38. *ἀνθρώποισι κακὰ ἐξ ἀγαθῶν φύεται, ἐπήν τις τἀγαθὰ μὴ 'πιστῆται ποδηγετεῖν μηδὲ ὀχεῖν εὐπόρως. οὐ δίκαιον ἐν κακοῖσι τὰ τοιάδε κρίνειν, ἀλλ' ἐν ἀγαθοῖσιν ὧν· τοῖς τε ἀγαθοῖσιν οἷον τε χρῆσθαι καὶ πρὸς τὰ κακά, εἴ τινι βουλομένῳ, ἀλκῇ.*
Diels ὧν; mss. ὧν: Diels ἀλκῇ; mss. ἀλκήν
II.9.2

D39. *ὁ μὲν εὔθυμος εἰς ἔργα ἐπιφερόμενος δίκαια καὶ νόμιμα καὶ ὕπαρ καὶ ὄναρ χαίρει τε καὶ ἔρρωται καὶ ἀνακηδὴς ἐστιν· ὃς δ' ἂν καὶ δίκης ἀλογῇ καὶ τὰ χρὴ ἐόντα μὴ ἔρδῃ, τούτῳ πάντα τὰ τοιαῦτα ἀτερπείη, ὅταν τευ ἀναμνησθῇ, καὶ δέδοικε καὶ ἑωυτὸν κακίζει.*
Mullach ἀνακηδής; mss. ἀνακύδης
II.9.3

D40. *οἱ θεοὶ τοῖσι ἀνθρώποισι διδοῦσι τἀγαθὰ πάντα καὶ πάλαι καὶ νῦν, πλὴν ὁκόσα κακὰ καὶ βλαβερὰ καὶ ἀνωφελέα. τάδε δ'οὔτε πάλαι οὔτε νῦν θεοὶ ἀνθρώποισι δωροῦνται, ἀλλ' αὐτοὶ τοῖσδεσιν ἐμπελάζουσι διὰ νοῦ τυφλότητα καὶ ἀγνωμοσύνην.*
II.9.4

D41. *τύχη μεγαλόδωρος, ἀλλ' ἀβέβαιος, φύσις δὲ αὐτάρκης· διόπερ νικᾷ τῷ ἧσσονι καὶ βεβαίῳ τὸ μεῖζον τῆς ἐλπίδος.*
II.9.5

Ethical Sayings from the Collection of Stobaeus

D36. Do not try to know everything, lest you become ignorant of everything.
II.1.12

II.4.12 [= Democrates 51]

II.7.3 [= **D24** and **D25**]

II.8.16 [= **D29**]

D37. From the very same things as benefit us we may also get evils, and escape from evils. For example, deep water is useful for many things, and then again bad; for there is danger of drowning. So a remedy has been discovered, teaching people to swim.
II.9.1

D38. Evils accrue to people from good things, when one does not know how to direct the good things or possess them advantageously. So it is not right to judge such things as evils, but as goods; and being able to make use of good things is also a protection against evils, if one so chooses.
II.9.2

D39. The cheerful man who undertakes right and lawful deeds rejoices sleeping and waking, and is strong and free from care; but he who takes no heed of what is right and does not do what he should is distressed by all those things, whenever he remembers any of them, and is frightened and reproaches himself.
II.9.3

D40. The gods give all good things to men both of old and now. But such things as are bad and harmful and useless, neither of old nor now do the gods bestow those things on men, but they run into them themselves through blindness of mind and lack of judgment.
II.9.4

D41. Fortune gives great gifts, but is undependable, while nature is self-sufficient; so its dependable inferiority excels the greater advantage which one hopes for [sc. from fortune].
II.9.5

II.15.33 [= Democrates 53]

II.15.36 [= Democrates 55]

D42. *οὔτε λόγος ἐσθλὸς φαύλην πρῆξιν ἀμαυρίσκει, οὔτε πρῆξις ἀγαθὴ λόγου βλασφημίῃ λυμαίνεται.*
II.15.40

D43. *πάντων κάκιστον ἡ εὐπετείη παιδεῦσαι τὴν νεότητα· αὕτη γάρ ἐστι ἣ τίκτει τὰς ἡδονὰς ταύτας, ἐκ τῶν ἡ κακότης γίνεται.*
ms. *δημοκράτους*
II.31.56

D44. *ἐξωτικῶς μὴ πονέειν παῖδες ἀνιέντες οὔτε γράμματ' ἂν μάθοιεν οὔτε μουσικὴν οὔτε ἀγωνίην οὐδ' ὅπερ μάλιστα τὴν ἀρετὴν ξυνέξει, τὸ αἰδεῖσθαι· μάλα γὰρ ἐκ τούτων φιλέει γίνεσθαι ἡ αἰδώς.*
ζηλωτικῶς ὁμῆ πονέειν Wachsmuth.
II.31.57

D45. *ἡ παιδεία εὐτυχοῦσι μέν ἐστι κόσμος, ἀτυχοῦσι δὲ καταφύγιον.*
II.31.58

D46. *κρείσσων ἐπ' ἀρετήν φανεῖται προτροπῇ χρώμενος καὶ λόγου πειθοῖ ἤπερ νόμῳ καὶ ἀνάγκῃ. λάθρῃ μὲν γὰρ ἁμαρτέειν εἰκὸς τὸν εἰργμένον ἀδικίης ὑπὸ νόμου, τὸν δὲ ἐς τὸ δέον ἡγμένον πειθοῖ οὐκ εἰκὸς οὔτε λάθρῃ οὔτε φανερῶς ἔρδειν τι πλημμελές. διόπερ συνέσει τε καὶ ἐπιστήμῃ ὀρθοπραγέων τις ἀνδρεῖος ἅμα καὶ εὐθύγνωμος γίγνεται.*
II.31.59

II.31.65 [= **D28**]

D47. *τὰ μὲν καλὰ χρήματα τοῖς πόνοις ἡ μάθησις ἐξεργάζεται, τὰ δ'αἰσχρὰ ἄνευ πόνων αὐτόματα καρποῦται. καὶ γὰρ οὖν οὐκ ἐθέλοντα πολλάκις ἐξείργει τοιοῦτον εἶναι οὕτω †μεγάλης τε τῆς φυτικῆς ἐστι†.*
II.31.66

II.15.33 [= Democrates 53]

II.15.36 [= Democrates 55]

D42. Fine speech does not obscure a bad act, nor is a good act spoiled by the calumny of speech.
II.15.40

D43. Ease is the worst of all teachers for the young; for it is that which gives birth to those pleasures from which wickedness arises.
II.31.56
[The main manuscript ascribes this maxim to Democrates, and the following sequence **44–6** to 'the same author.']

D44. Children who are allowed not to take pains ... would not learn letters or music or athletics or respect, which above all maintains virtue; for it is from those things especially that respect tends to arise.
II.31.57
[The main manuscript indicates that 'to take pains' is qualified by an adverb, but the sense of the ms. text 'in a foreign fashion' is unsatisfactory. Wachsmuth emends to give 'allowed to take pains in emulation of one another.']

D45. Education is an adornment in good fortune and a refuge in misfortune.
II.31.58

D46. One will seem to promote virtue better by using encouragement and persuasion of speech than law and necessity. For it is likely that he who is held back from wrongdoing by law will err in secret, but that he who is urged to what he should by persuasion will do nothing wrong either in secret or openly. Therefore he who acts rightly from understanding and knowledge proves to be at the same time courageous and right-minded.
II.31.59

II.31.65 [= **D28**]

D47. Learning achieves fine things through taking pains, but evils one acquires of themselves without any pains. And indeed they often prevent someone, even against his will, from being such ... [remainder of text uncertain].
II.31.66

II.31.71 [= Democrates 59]

D48. *ἔστι που νέων ξύνεσις καὶ γερόντων ἀξυνεσίη· χρόνος γὰρ οὐ διδάσκει φρονεῖν, ἀλλ' ὡραίη τροφὴ καὶ φῦσις.*
II.31.72

II.31.73 [= Democrates 85]

D49. *φαύλων ὁμιλίη συνεχὴς ἕξιν κακίης συναύξει.*
II.31.90

D50. *κρέσσονές εἰσιν αἱ τῶν πεπαιδευμένων ἐλπίδες ἢ τῶν ἀμαθῶν πλοῦτος.*
II.31.94

D51. *ὁμοφροσύνη φιλίην ποιεῖ.*
II.33.9

D52. *ἀνθρώποις ἁρμόδιον ψυχῆς μᾶλλον ἢ σώματος λόγον ποιεῖσθαι· ψυχῆς μὲν γὰρ τελεότης σκήνεος μοχθηρίην ὀρθοῖ, σκήνεος δὲ ἰσχὺς ἄνευ λογισμοῦ ψυχὴν οὐδέν τι ἀμείνω τίθησιν.* [Fuller version of Democrates 36]
III.1.27

III.1.45 [= Democrates 47]

III.1.46 [= **D26**]

D53. *ἄριστον ἀνθρώπῳ τὸν βίον διάγειν ὡς πλεῖστα εὐθυμηθέντι καὶ ἐλάχιστα ἀνιηθέντι. τοῦτο δ' ἂν εἴη, εἴ τις μὴ ἐπὶ τοῖς θνητοῖσι τὰς ἡδονὰς ποιοῖτο.*
III.1.47

D54. *φαύλων ἔργων καὶ τοὺς λόγους παραιτητέον.*
III.1.91

III.1.95 [= Democrates 41]

II.31.71 [= Democrates 59]

D48. There is understanding among the young and lack of understanding among the old; for it is not time which teaches one to think, but mature development and nature.
II.31.72

II.31.73 [= Democrates 85]

D49. Continuous association with the wicked promotes a bad state of character.
II.31.90

D50. The hopes of the educated are better than the wealth of the ignorant.
II.31.94

D51. Like-mindedness makes friendship.
II.33.9

D52. It is fitting for people to take account of the soul rather than the body. For perfection of the soul puts right the bad state of the dwelling [i.e., the body, the dwelling-place of the soul], but strength of the dwelling without thought does not make the soul any better. [Fuller version of Democrates 36]
III.1.27

III.1.45 [= Democrates 47]

III.1.46 [= **D26**]

D53. The best thing for a man is to live his life as cheerfully as possible, and with the least distress. And that would be if one did not take one's pleasures in mortal things.
III.1.47

D54. One should avoid even accounts of bad acts.
III.1.91

III.1.95 [= Democrates 41]

D55. *ἀνθρώποισι γὰρ εὐθυμίη γίνεται μετριότητι τέρψιος καὶ βίου συμμετρίῃ· τὰ δ' ἐλλείποντα καὶ ὑπερβάλλοντα μεταπίπτειν τε φιλεῖ καὶ μεγάλας κινήσιας ἐμποιεῖν τῇ ψυχῇ. αἱ δ' ἐκ μεγάλων διαστημάτων κινούμεναι τῶν ψυχέων οὔτε εὐσταθέες εἰσιν οὔτε εὔθυμοι. ἐπὶ τοῖς δυνατοῖς οὖν δεῖ ἔχειν τὴν γνώμην καὶ τοῖς παρεοῦσιν ἀρκέεσθαι τῶν μὲν ζηλουμένων καὶ θαυμαζομένων ὀλίγην μνήμην ἔχοντα καὶ τῇ διανοίῳ μὴ προσεδρεύοντα, τῶν δὲ ταλαιπορεόντων τοὺς βίους θεωρέειν, ἐννοούμενον ἃ πάσχουσι κάρτα, ὅκως τὰ παρεόντα σοι καὶ ὑπάρχοντα μέγαλα καὶ ζηλωτὰ φαίνηται, καὶ μηκέτι πλεινόνων ἐπιθυμέοντι συμβαίνῃ κακοπαθεῖν τῇ ψυχῇ. ὁ γὰρ θαυμάζων τοὺς ἔχοντας καὶ μακαριζομένους ὑπὸ τῶν ἄλλων ἀνθρώπων καὶ τῇ μνήμῃ πᾶσαν ὥραν προσεδρεύων ἀεὶ ἐπικαινουργεῖν ἀναγκάζεται καὶ ἐπιβάλλεσθαι δἰ ἐπιθυμίην τοῦ τι πρήσσειν ἀνήκεστον ὧν νόμοι κωλύουσιν. διόπερ τὰ μὲν μὴ δίζεσθαι χρεών, ἐπὶ δὲ τοῖς εὐθυμέεσθαι χρεών, παραβάλλοντα τὸν ἑαυτοῦ βίον πρὸς τὸν τῶν φαυλότερον πρησσόντων καὶ μακαρίζειν ἑωυτὸν ἐνθυμεύμενον ἃ πάσχουσιν, ὁκόσῳ αὐτέων βέλτιον πρήσσει τε καὶ διάγει. ταύτης γάρ ἐχόμενος τῆς γνώμης εὐθυμότερον τε διάξεις καὶ οὐκ ὀλίγους κῆρας ἐν τῷ βίῳ διώσεαι, φθόνον καὶ ζῆλον καὶ δυσμενίην.*
III.1.210

D56. *ἔστι ῥᾴδιον μὲν ἐπαινεῖν ἃ μὴ χρὴ καὶ ψέγειν, ἑκάτερον δὲ πονηροῦ τινος ἤθους.*
III.2.36

D57. *φρονήσιος ἔργον μέλλουσαν ἀδικίην φυλάξασθαι, ἀναλγησίης δὲ το γενομένην μὴ ἀμύνασθαι.*
III.3.43

D58. *αἱ μεγάλαι τέρψεις ἀπὸ τοῦ θεᾶσθαι τὰ καλὰ τῶν ἔργων γίνονται.*
III.3.46

III.4.51 [= first sentence of **D38**]

D59. *εἴδωλα ἐσθῆτι καὶ κόσμῳ διαπρεπέα πρὸς θεωρίην, ἀλλὰ καρδίης κενεά.*
III.4.69

D60. *λήθη τῶν ἰδίων κακῶν θρασύτητα γεννᾷ.*
III.4.70

D61. *ἀνοήμονες ῥυσμοῦνται τοῖς τῆς τύχης κέρδεσιν, οἱ δὲ τῶν τοιῶνδε δαήμονες τοῖς τῆς σοφίης.*

D55. For men achieve cheerfulness by moderation in pleasure and by proportion in their life; excess and deficiency are apt to fluctuate and cause great changes in the soul. And souls which change over great intervals are neither stable nor cheerful. So one should set one's mind on what is possible and be content with what one has, taking little account of those who are admired and envied, and not dwelling on them in thought, but one should consider the lives of those who are in distress, thinking of their grievous sufferings, so that what one has and possesses will seem great and enviable, and one will cease to suffer in one's soul through the desire for more. For he who admires those who have and who are congratulated by others and is always dwelling on them in his memory is continually obliged to get up to new tricks and in his desire to achieve something to attempt some wicked deed which is forbidden by the laws. Therefore one should not seek those things, but should be cheerful at the thought of the others, comparing one's own life with that of those who are faring worse, and should congratulate oneself when one thinks of what they are suffering, and how much better one is doing and living than they are. For by maintaining that frame of mind one will live more cheerfully and will avert not a few evils in one's life, jealousy and envy and malice.
III.1.210

D56. It is easy to praise and to censure what one should not, but either is the mark of a bad character.
III.2.36

D57. It is the work of intelligence to guard against future wrongdoing, but of insensitivity not to retaliate once it is done.
III.3.43

D58. Great delights come from beholding fine deeds.
III.3.46

III.4.51 [= first sentence of **D38**]

D59. Images beautiful to behold in dress and ornament, but empty of heart.
III.4.69

D60. Forgetting one's own ills makes one bold.
III.4.70

D61. The unwise are shaped by the gifts of fortune, but those who understand such things by the gifts of wisdom.

ms. ψυχῆς, Grotius τύχης
III.4.71

D62. τὸ χρῄζον οἶδεν ὁκόσον χρῄζει, ὁ δὲ χρῄζων οὐ γιγνώσκει.
III.4.72

D63. ἀνοήμονες τὸ ζῆν ὡς στυγέοντες ζῆν ἐθέλουσιν δείματι ἀίδεω.
III.4.73

D64. ἀνοήμονες βιοῦσιν οὐ τερπόμενοι βιοτῇ.
III.4.74

D65. ἀνοήμονες δηναιότητος ὀρέγονται οὐ τερπόμενοι δηναιότητι.
III.4.75

D66. ἀνοήμονες τῶν ἀπεόντων ὀρέγονται, τὰ δὲ παρέοντα καὶ παρῳχημένων κερδαλεώτερα ἐόντα ἀμαλδύνουσιν.
III.4.76

D67. ἄνθρωποι τόν θάνατον φεύγοντες διώκουσιν.
III.4.77

D68. ἀνοήμονες οὐδέν' ἀνδάνουσιν ἐν ὅλῃ τῇ βιοτῇ.
III.4.78

D69. ἀνοήμονες ζωῆς ὀρέγονται <καὶ> γήραος θάνατον δεδοικότες.
Taylor <καὶ>: Diels deletes γήραος
III.4.79

D70. ἀνοήμονες θάνατον δεδοικότες γηράσκειν ἐθέλουσιν.
III.4.80

III.4.81 [= Democrates 64]

III.4.82 [= Democrates 77]

D71. ἡδονὴν οὐ πᾶσαν, ἀλλὰ τὴν ἐπὶ τῷ καλῷ αἱρεῖσθαι χρεών.
III.5.22

III.5.23 [= Democrates 73]

III.4.71

D62. The thing that is in need knows how much it needs, but the man who is in need does not know.
III.4.72

D63. The unwise hate their life, yet want to live for fear of Hades.
III.4.73

D64. The unwise live without delighting in their life.
III.4.74

D65. The unwise desire a long life without delighting in a long life.
III.4.75

D66. The unwise desire the things they do not have, but the things they have they neglect, though they are more profitable than the things that are gone.
III.4.76

D67. In fleeing death men seek it.
III.4.77

D68. The unwise please no one in their whole life.
III.4.78

D69. The unwise desire life and old age through fear of death.
III.4.79

D70. The unwise wish to grow old through fear of death.
III.4.80

III.4.81 [= Democrates 64]

III.4.82 [= Democrates 77]

D71. One should choose, not every pleasure, but pleasure in what is fine.
III.5.22

III.5.23 [= Democrates 73]

D72. *πατρὸς σωφροσύνη μέγιστον τέκνοις παράγγελμα.*
III.5.24

D73. *αὐταρκείῃ τροφῆς σμικρὴ νὺξ οὐδέποτε γίνεται.*
III.5.25

D74. *τραπέζαν πολυτελέα μὲν τύχη παρατίθησιν, αὐταρκέα δὲ σωφροσύνη.*
III.5.26

D75. *σωφροσύνη τὰ τερπνὰ ἀέξει καὶ ἡδονὴν ἐπιμείζονα ποιεῖ.*
III.5.27

III.6.26 [= second sentence of **D78**]

D76. *ἡμερέσιοι ὕπνοι σώματος ὄχλησιν ἢ ψυχῆς ἀδημοσύνην ἢ ἀργίην ἢ ἀπαιδευσίην σημαίνουσιν.*
III.6.27

III.6.28 [= **D8** *ξυνουσίη . . . ἀνθρώπου*]

III.6.59 [= **D96**]

III.6.60 [= **D97**]

D77. *ἀνδρείη τὰς ἄτας μικρὰς ἔρδει.*
III.7.21

D78. *ἀνδρεῖος οὐχ ὁ τῶν πολεμίων μόνον, ἀλλὰ καὶ ὁ τῶν ἡδονῶν κρείσσων. ἔνιοι δὲ πόλεων μὲν δεσπόζουσι, γυναιξὶ δὲ δουλεύουσιν.*
III.7.25

D79. *δίκης κῦδος γνώμης θάρσος καὶ ἀθαμβίη, ἀδικίης δὲ τέρμα ξυμφορῆς δεῖμα.*
Kranz *τέρμα ξυμφορῆς δεῖμα;* mss. *δεῖμα ξ. τέρμα.*
III.7.31

D80. *σοφίη ἄθαμβος ἀξίη πάντων τιμιωτάτη οὖσα.*
III.7.74

D72. The self-control of the father is the best exhortation to the children.
III.5.24

D73. To one who is self-sufficient in respect of food, the night is never short. [Sense uncertain]
III.5.25

D74. Fortune provides a lavish table, self-control a sufficient one.
III.5.26

D75. Self-control increases delights and makes pleasure greater.
III.5.27

III.6.26 [= second sentence of **D78**]

D76. Sleeping during the day indicates bodily disturbance or distress of mind or idleness or lack of education.
III.6.27

III.6.28 [= **D8** 'Sexual intercourse ... from man.']

III.6.59 [= **D96**]

III.6.60 [= **D97**]

D77. Courage makes disasters small.
III.7.21

D78. The courageous man is he who overcomes, not only the enemy, but pleasures also. But some are masters of cities, yet slaves to women.
III.7.25

D79. The glory of justice is boldness and an untroubled mind, but the end of injustice is the fear of disaster.[8]
III.7.31

D80. Untroubled wisdom is worth all, for it is most valuable.
III.7.74

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8 Procopé 113b, p. 35 translates the mss. text 'the dread of injustice [i.e., what injustice has to fear] <is> a disastrous ending.'

III.9.29 [= Democrates 62]

D81. *μοῦνοι θεοφιλέες, ὅσοις ἐχθρὸν τὸ ἀδικέειν.*
III.9.30

D82. *πλοῦτος ἀπὸ κακῆς ἐργασίης περιγινόμενος ἐπιφανέστερον τὸ ὄνειδος κέκταται.*
III.10.36

III.10.42 [= Democrates 52]

D83. *χρημάτων ὄρεξις, ἣν μὴ ὁρίζηται κόρῳ, πενίης ἐσχάτης πολλὸν χαλεπωτέρη· μέζονες γὰρ ὀρέξεις μέζονας ἐνδείας ποιεῦσιν.*
III.10.43

D84. *κακὰ κέρδεα ζημίαν ἀρετῆς φέρει.*
III.10.44

D85. *ἐλπὶς κακοῦ κέρδεος ἀρχὴ ζημίης.*
III.10.58

D86. *ἡ τέκνοις ἄγαν χρημάτων συναγωγὴ πρόφασίς ἐστι φιλαργυρίης τρόπον ἴδιον ἐλέγχουσα.*
III.10.64

D87. *ὧν τὸ σκῆνος χρῄζει, πᾶσι πάρεστιν εὐμαρέως ἄτερ μόχθου καὶ ταλαιπωρίης· ὁκόσα δὲ μόχθου καὶ ταλαιπωρίης χρῄζει καὶ βίου ἀλγύνει, τοῦτων οὐκ ἰμείρεται τὸ σκῆνος, ἀλλ' ἡ τῆς γνώμης κακοηθίη.*
Wilamowitz *κακοηθίη*; mss. *κακοθηγίη, καθοδιγίη*; Diels *κακοθιγίη*
III.10.65

D88. *ἡ τοῦ πλέονος ἐπιθυμίη τὸ παρεὸν ἀπόλλυσι τῇ Αἰσωπείῃ κυνὶ ἰκέλη γινομένη.*
III.10.68

D89. *ἀληθομυθέειν χρεών, οὐ πολυλογέειν*
Diels *οὐ πολυλογέειν*; mss. *ὅπου λώιον*; Buecheler *ὃ πολὺ λώιον*
III.12.13

III.9.29 [= Democrates 62]

D81. They alone are loved by the gods, to whom wrongdoing is hateful.
III.9.30

D82. Wealth acquired by wicked deeds makes the disgrace more apparent.
III.10.36

III.10.42 [= Democrates 52]

D83. The desire for wealth, if not limited by satiety, is much harder to endure than the most extreme poverty; for greater desires create greater lacks.
III.10.43

D84. Wicked gains bring loss of virtue.
III.10.44

D85. The hope of wicked gain is the beginning of loss.
III.10.58

D86. Piling up too much wealth for one's children is a pretext for covetousness, which exposes itself.
III.10.64

D87. The things the body needs are easily available to everyone without labour and trouble; things that need labour and trouble and burden life are desired, not by the body, but by the bad state of the mind.
III.10.65

D88. The desire for more destroys what one has, like the dog in Aesop's fable.
III.10.68

D89. One should tell the truth, not talk a lot.
III.12.13
['Not talk a lot' translates the text adopted by Diels, which assimilates this maxim to Democrates 44, in preference to the unintelligible manuscript text, literally translated 'where better.' Wachsmuth, following Buecheler, amends the latter to 'which is much better.']

III.13.46 [= Democrates 60]

D90. *οἰκήιον ἐλευθερίης παρρησίη, κίνδυνος δὲ ἡ τοῦ καιροῦ διάγνωσις.*
III.13.47

III.14.8 [= Democrates 63]

D91. *οἱ φειδωλοὶ τὸν τῆς μελίσσης οἶτον ἔχουσιν ἐργάζομενοι ὡς ἀεὶ βιωσόμενοι.*
III.16.17

D92. *οἱ τῶν φειδωλῶν παῖδες ἀμαθέες γινόμενοι, ὥσπερ οἱ ὀρχησταὶ οἱ ἐς τὰς μαχαίρας ὀρούοντες, ἢν ἑνὸς μούνου < μὴ> τύχωσι καταφερόμενοι, ἔνθα δεῖ τοὺς πόδας ἐρεῖσαι, ἀπόλλυνται· χαλεπὸν δὲ τυχεῖν ἑνός, τὸ γὰρ ἴχνιον μοῦνον λέλειπται τῶν ποδῶν· οὕτω δὲ καὶ οὗτοι, ἢν ἁμάρτωσι τοῦ πατρικοῦ τύπου τοῦ ἐπιμελέος καὶ φειδωλοῦ, φιλέουσι διαφθείρεσθαι.*
III.16.18

D93. *φειδώ τοι καὶ λιμὸς χρηστή, ἐν καιρῷ δὲ καὶ δαπάνη· γινώσκειν δὲ ἀγαθοῦ.*
III.16.19

D94. *βίος ἀνεόρταστος μακρὴ ὁδὸς ἀπανδόκευτος.*
III.16.22

D95. *εὐγνώμων ὁ μὴ λυπεόμενος ἐφ' οἷσιν οὐκ ἐχει, ἀλλὰ χαίρων ἐφ' οἷσιν ἔχει.*
III.17.25

D96. *τῶν ἡδέων τὰ σπανιώτατα γινόμενα μάλιστα τέρπει.*
III.17.37

D97. *εἴ τις ὑπερβάλλοι τὸ μέτριον, τὰ ἐπιτερπέστατα ἀτερπέστατα ἂν γίγνοιτο.*
III.17.38

III.17.39 [= first sentence of **D78**]

D98. *ὑγιείην εὐχῇσι παρὰ θεῶν αἰτέονται ἄνθρωποι, τὴν δὲ ταύτης δύναμιν ἐν ἑαυτοῖς ἔχοντες οὐκ ἴσασιν· ἀκρασίῃ δὲ τἀνάντια πρήσσοντες αὐτοὶ προδόται τῆς ὑγιείης τῇσιν ἐπιθυμιῇσιν γίνονται.*

III.13.46 [= Democrates 60]

D90. Free speech is a part of freedom, but there is risk in choice of the right time.
III.13.47

III.14.8 [= Democrates 63]

D91. The thrifty share the fate of the bee; they work as if they were going to live for ever.
III.16.17

D92. If the children of the thrifty turn out stupid, they are like people dancing on swords; if they make even one mistake in putting their feet down, they are lost (and it is difficult to find the precise place, for only the size of a footprint is left free). In the same way, if those people fail to acquire their father's cautious and thrifty character, they are apt to be ruined.
III.16.18

D93. Thrift and hunger are useful, and expense too at the right time. It is the mark of the good man to discern.
III.16.19

D94. A life without feasts is a long road without an inn.
III.16.22

D95. Wise is he who does not grieve over what he does not have, but rejoices in what he has.
III.17.25

D96. Those pleasures which occur most rarely give the greatest delight.
III.17.37

D97. If someone were to exceed the appropriate measure, the most delighful things would become most unpleasant.
III.17.38

III.17.39 [= first sentence of **D78**]

D98. People ask the gods for health in their prayers, but do not realize that the control of their health lies with them; through lack of self-control they act in opposition to it and so themselves betray their health to their desires.

Diels, Wachsmuth (following Meineke) *ὑγιείην εὐχῇσι*; mss. *ὑγιεινὴν εὐχήν*.
III.18.30

D99. *ὅσοι ἀπὸ γαστρὸς τὰς ἡδονὰς ποιέονται ὑπερβεβληκότες τὸν καιρὸν ἐπὶ βρώσεσιν ἢ πόσεσιν ἢ ἀφροδισίοισιν, τοῖσι πᾶσιν αἱ μὲν ἡδοναὶ βραχεῖαί τε καὶ δὶ ὀλίγου γίνονται, ὁκόσον ἂν χρόνον ἐσθίωσιν ἢ πίνωσιν, αἱ δὲ λῦπαι πολλαί. τοῦτο μὲν γὰρ τὸ ἐπιθυμεῖν ἀεὶ τῶν αὐτῶν πάρεστι καὶ ὁκόταν γένηται ὁκοίων ἐπιθυμέουσι, διὰ ταχέος τε ἡ ἡδονὴ παροίχεται, καὶ οὐδὲν ἐν αὐτοῖσι χρηστόν ἐστιν ἀλλ' ἢ τέρψις βραχεῖα, καὶ αὖθις τῶν αὐτῶν δεῖ.*
III.18.35

D100. *θυμῷ μάχεσθαι μὲν χαλεπόν· ἀνδρὸς δὲ τὸ κρατέειν εὐλογίστου.*
III.20.56

D101. *φιλονικίη πᾶσα ἀνόητος· τὸ γὰρ κατὰ τοῦ δυσμενέος βλαβερὸν θεωρεῦσα τὸ ἴδιον συμφέρον οὐ βλέπει.*
III.20.62

D102. *τελευτᾷ γὰρ ἐς κακοδοξίην [κακὴν] ὁ παρεκτεινόμενος τῷ κρέσσονι.*
Diels (following Meineke) del. *κακὴν*; Buecheler *κενοδοξίην κακὴν*
III.22.42

D103. *ὅρκους οὕς ποιέονται ἐν ἀνάγκῃσιν ἐόντες οὐ τηρέουσιν οἱ φλαῦροι ἐπὴν διαφύγωσιν.*
III.28.13

D104. *οἱ ἑκούσιοι πόνοι τὴν τῶν ἀκουσίων ὑπομονὴν ἐλαφροτέρην παρασκευάζουσιν.*
III.29.63

D105. *πόνος συνεχὴς ἐλαφρότερος ἑαυτοῦ συνηθείῃ γίνεται.*
III.29.64

D106. *πλέονες ἐξ ἀσκήσιος ἀγαθοὶ γίνονται ἢ ἀπὸ φύσιος.*
III.29.66

III.29.67 [= Democrates 81]

III.18.30

D99. Those who take their pleasures from their belly, exceeding what is appropriate in food or drink or sex, to all of them their pleasures are meagre and brief, lasting just so long as they are eating and drinking, and their pains are many. For this desire for the same thing is always with them, even when they get what they desire, and the pleasure soon passes, and they have no profit except brief delight, and then they need the same things again.
III.18.35
[= III.6.65, ascribed to Epictetus]

D100. It is hard to fight against spirit; but mastering it is the mark of the prudent man.
III.20.56
['It ... spirit' also attributed to Heraclitus (DK 22 B85)]

D101. All rivalry is stupid; it looks to the harm of one's enemy instead of to one's own advantage.
III.20.62

D102. He who measures himself against someone better ends up with a bad reputation.
III.22.42

D103. The wicked do not keep the oaths they swear in extremities once they have escaped from them.
III.28.13

D104. Toils undertaken voluntarily make it easier to endure those which come unbidden.
III.29.63

D105. Continuous toil becomes easier to bear as you get used to it.
III.29.64

D106. More people become good by practice than by nature.
III.29.66

III.29.67 [= Democrates 81]

D107. *τῆς ἡσυχίης πάντες οἱ πόνοι ἡδίονες, ὅταν ὧν εἵνεκεν πονέουσι τυγχάνουσιν ἢ εἰδέωσι κύρσοντες. ἐν δὲ ἑκάστῃ ἀποτυχίῃ τὸ πονέειν ὁμοίως ἀνιηρὸν καὶ ταλαίπωρον.*
Diels *ἐν δὲ . . . πονεῖν;* Mullach *πονέειν;* mss. *ἓν δὲ ἄκος τῇ ἀποτυχίῃ τὸ πᾶν.*
III.29.88

D108. *φαῦλον, κἂν μόνος ᾖς, μήτε λέξῃς μήτ' ἐργάσῃ· μάθε δὲ πολὺ μᾶλλον τῶν ἄλλων σεαυτὸν αἰσχύνεσθαι.*
III.31.7

III.36.24 [= Democrates 86]

III.37.22 [= Democrates 39]

III.37.25 [= Democrates 61]

III.38.46 [= Democrates 48]

III.38.47 [= Democrates 88]

D109. *οὐκ ἂν ἐκώλυον οἱ νόμοι ζῆν ἕκαστον κατὰ τὴν ἐξουσίην, εἰ μὴ ἕτερος ἕτερον ἐλυμαίνετο· φθόνος γὰρ στάσιος ἀρχὴν ἀπεργάζεται.*
III.38.53

D110. *ξενιτείη βίου αὐτάρκειαν διδάσκει· μᾶζα γὰρ στιβὰς λιμοῦ καὶ κόπου γλυκύτατα ἰάματα.*
III.40.6

D111. *ἀνδρὶ σοφῷ πᾶσα γῆ βατή· ψυχῆς γὰρ ἀγαθῆς πατρὶς ὁ ξύμπας κόσμος.*
III.40.7

D107. All toils are pleasanter than ease, when people achieve the goal of their toil or know that they will reach it. But in every failure one's toil is equally unpleasant and troublesome.[9]
III.29.88

D108. Even when you are alone, neither say nor do anything bad; learn to feel shame before yourself much more than before others.
III.31.7
[Cf. **D128**: Democrates 84.]

III.36.24 [= Democrates 86]

III.37.22 [= Democrates 39]

III.37.25 [= Democrates 61]

III.38.46 [= Democrates 48]

III.38.47 [= Democrates 88]

D109. The laws would not prevent each person from living as he pleased, if one did not harm another; it is envy which prompts the beginning of civil strife.[10]
III.38.53

D110. Foreign travel teaches self-sufficiency; barley-bread and straw are the pleasantest remedies for hunger and weariness.
III.40.6

D111. To the wise man every land is to be travelled; for the whole world is the native land of the good soul.
III.40.7

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9 Langerbeck 11, p. 62 translates the ms. text, rendering 'in misfortune there is one remedy, that which is similarly irremediable and painful' (i.e., the remedy for misfortune is comparison with similar misfortune suffered by others). Cf. **D55**.

10 On the argument see Procopé 113b, pp. 42–3.

D112. *ὁ νόμος βούλεται μὲν εὐεργετεῖν βίον ἀνθρώπων· δύναται δέ, ὅταν αὐτοὶ βούλωνται πάσχειν εὖ· τοῖσι γὰρ πειθομένοισι τὴν ἰδίην ἀρετὴν ἐνδείκνυται.*
IV.1.33

D113. *στάσις ἐμφύλιος ἐς ἑκάτερα κακόν· καὶ γὰρ νικέουσι καὶ ἡσσωμένοις ὁμοίη φθορή.*
IV.1.34

D114. *ἀπὸ ὁμονοίης τὰ μέγαλα ἔργα καὶ ταῖς πόλεσι τοὺς πολέμους δυνατὸν κατεργάζεσθαι, ἄλλως δ' οὔ.*
IV.1.40

D115. *ἡ ἐν δημοκρατίῃ πενίη τῆς παρὰ ταῖς δυνάστῃσι καλεομένης εὐδαιμονίης τοσοῦτόν ἐστι αἱρετωτέρη, ὁκόσον ἐλευθερίη δουλείης.*
IV.1.42

D116. *τὰ κατὰ τὴν πόλιν χρεὼν τῶν λοιπῶν μέγιστα ἡγεῖσθαι, ὅκως ἄξεται εὖ, μήτε φιλονικέοντα παρὰ τὸ ἐπιεικὲς μήτε ἰσχὺν ἑαυτῷ περιτιθέμενον παρὰ τὸ χρηστὸν τὸ τοῦ ξυνοῦ. πόλις γὰρ εὖ ἀγομένη μεγίστη ὄρθωσίς ἐστι, καὶ ἐν τούτῳ πάντα ἔνι, καὶ τούτου σῳζομένου πάντα σῴζεται καὶ τούτου διαφθειρομένου τὰ πάντα διαφθείρεται.*
IV.1.43

D117. *τοῖς χρηστοῖσιν οὐ συμφέρον ἀμελέοντας τῶν ἑωυτῶν ἄλλα πράσσειν· τὰ γὰρ ἴδια κακῶς ἔσχεν. εἰ δὲ ἀμελέοι τις τῶν δημοσίων, κακῶς ἀκούειν γίγνεται, καὶ ἦν μηδὲν κλέπτῃ μήτε ἀδικῇ. ἐπεὶ καὶ <μὴ> ἀμελέοντι ἢ ἀδικέοντι κίνδυνος κακῶς ἀκούειν καὶ δὴ καὶ παθεῖν τι· ἀνάγκη γὰρ ἁμαρτάνειν, συγγινώσκεσθαι δὲ τοὺς ἀνθρώπους οὐκ εὐπετές.*
Diels, Wachsmuth (following Meineke) <μὴ>
IV.1.44

D118. *οἱ κακοὶ ἴοντες ἐς τὰς τιμὰς ὁκόσῳ ἂν μᾶλλον ἀνάξιοι ἐόντες ἴωσι, τοσούτῳ μᾶλλον ἀνακηδέες γίγνονται καὶ ἀφροσύνης καὶ θράσεος πίμπλανται.*
Diels, Wachsmuth (following Meineke) *ἀνακηδέες*; mss. *ἂν ἀκυδέες, ἀνακυδέες, ἂν ἀκηδέες*
IV.1.45

D112. It is the aim of law to benefit the life of men; and it can, provided they wish to benefit from it. For it displays its goodness[11] to those who obey.
IV.1.33

D113. Civil strife is an evil for both parties; to victors and vanquished it brings like destruction.
IV.1.34

D114. From concord come great deeds, and for cities the ability to win wars, otherwise not.
IV.1.40

D115. Poverty in a democracy is as much more desirable than so-called well-being under tyrants as freedom is more desirable than slavery.
IV.1.42

D116. One should attach the greatest importance of all to the city's being well run, and not indulge in inappropriate rivalry or increase one's own power to the detriment of the community. For the city's being well run is the greatest good; everything is contained in that, if that is preserved everything is preserved, if that is destroyed everything is destroyed.
IV.1.43

D117. It is not advantageous for good men to do other things while neglecting their own affairs; for then their own affairs go badly. But if someone neglects communal affairs, he acquires a bad reputation, even if he does not steal or do any wrong. For even if one does not neglect those things or do wrong, one runs a risk of being slandered or harmed. One is bound to go wrong, and people are not inclined to make allowances.
IV.1.44

D118. When the bad assume official positions the more unworthy they are, the more heedless they become, and the more they are filled with folly and boldness.
IV.1.45

11 Or 'their goodness.'

D119. *ὅταν οἱ δυνάμενοι τοῖς μὴ ἔχουσι καὶ προτελεῖν τολμέωσι καὶ ὑπουργεῖν καὶ χαρίζεσθαι, ἐν τούτῳ ἤδη καὶ τὸ οἰκτίρειν ἔνεστι καὶ μὴ ἐρήμους εἶναι καὶ τὸ ἑταίρους γίγνεσθαι, καὶ τὸ ἀμύνειν ἀλλήλοισι καὶ τοὺς πολιήτας ὁμονόους εἶναι καὶ ἄλλα ἀγαθά. ἄσσα οὐδεὶς ἂν δύναιτο καταλέξαι.*
Correction in one ms. *ἑταίρους*; mss. *ἑτέρους*
IV.1.46

IV.2.13 [= Democrates 75]

D120. *δίκη μέν ἐστιν ἔρδειν τὰ χρὴ ἐόντα, ἀδικίη δὲ μὴ ἔρδειν τὰ χρὴ ἐόντα, ἀλλὰ παρατρέπεσθαι.*
IV.2.14

D121. *κατὰ δὲ ζῴων ἔστιν ὧν φόνου καὶ μὴ φόνου ὧδε ἔχει· τὰ ἀδικέοντα καὶ θέλοντα ἀδικεῖν ἀθῷος ὁ κτείνων, καὶ πρὸς εὐεστοῦν τοῦτο ἔρδειν μᾶλλον ἢ μή.*
IV.2.15

D122. *κτείνειν χρὴ τὰ πημαίνοντα παρὰ δίκην πάντα περὶ παντὸς· καὶ ταῦτα ὁ ποιῶν εὐθυμίης καὶ δίκης καὶ θάρσεος καὶ κτήσεως ἐν παντὶ κόσμῳ μέζω μοῖραν μεθέξει.*
IV.2.16

D123. *ὅκωσπερ περὶ κιναδέων τε καὶ ἑρπετέων γεγράφαται τῶν πολεμίων, οὕτω καὶ κατὰ ἀνθρώπων δοκεῖ μοι χρεὼν εἶναι ποιεῖν· κατὰ νόμους τοὺς πατρίους κτείνειν πολέμιον ἐν παντὶ κόσμῳ, ἐν ᾧ μὴ νόμος ἀπείργει· ἀπείργει δὲ ἱερὰ ἑκάστοισι ἐπιχώρια καὶ σπονδαὶ καὶ ὅρκοι.*
IV.2.17

D124. *κιξάλλην καὶ λῃστὴν πάντα κτείνων τις ἀθῷος ἂν εἴη καὶ αὐτοχειρίῃ καὶ κελεύων καὶ ψήφῳ.*
IV.2.18

IV.4.27 [= Democrates 49]

D119. When those who can venture to contribute to those without means and to help and favour them, this shows pity, so that they are not abandoned, and they become comrades and take one another's part and the citizens are in concord, and many other good things which one could not count.
IV.1.46

IV.2.13 [= Democrates 75]

D120. Justice is doing what should be, injustice not doing what should be, but turning aside from it.
IV.2.14

D121. Concerning the killing and not killing of some living things it stands thus: he who kills those which do or attempt to do wrong is free of punishment, and doing this contributes more to well-being than not.
IV.2.15

D122. One should kill in every case everything which causes unlawful harm; and he who does this shall receive in every form of community a greater share of cheerfulness and justice and confidence and possessions.[12]
IV.2.16

D123. As it has been written concerning hostile beasts and reptiles, so it seems to me one should do in the case of men. According to the ancestral laws one may kill an enemy in every form of community, provided that the law does not prohibit it; prohibitions are made by the religious enactments[13] of each state, by treaties, and by oaths.
IV.2.17

D124. Anyone who kills any highway robber or pirate, whether with his own hand or by his order or by his vote, should be free of punishment.
IV.2.18

IV.4.27 [= Democrates 49]

12 See Procopé 113b, p. 25.

13 Procopé 113b, p. 26 suggests that the reference is to the right of sanctuary in temple precincts; on that interpretation the translation is 'sacred shrines.'

D125. *ἀδικουμένοισι τιμωρεῖν κατὰ δύναμιν χρὴ καὶ μὴ παριέναι· τὸ μὲν γὰρ τοιοῦτον δίκαιον καὶ ἀγαθόν, τὸ δὲ μὴ τοιοῦτον ἄδικον καὶ κακόν.*
IV.5.43

D126. *καὶ οἱ φυγῆς ἄξια ἔρδουσιν ἢ δεσμῶν, ἢ θωῆς ἄξιοι, καταψηφιστέον καὶ μὴ ἀπολύειν· ὃς δ' ἂν παρὰ νόμον ἀπολύῃ κέρδει ὁρίζων ἢ ἡδονῇ, ἀδικεῖ, καὶ οἱ τοῦτο ἐγκάρδιον ἀνάγκη εἶναι.*
IV.5.44

D127. *δίκης καὶ ἀρετῆς μεγίστην μετέχει μοῖραν ὁ τιμὰς ἀξίως τὰς μεγίστας ταμιεύων.*
Gomperz *τιμὰς ἀξίως τὰς μεγίστας ταμιεύων*; mss. *τιμὰς ἀξίας τὰς μεγίστας τάμνων*
IV.5.45

D128. *μηδέν τι μᾶλλον τοὺς ἀνθρώπους αἰδεῖσθαι ἑωυτοῦ μηδέ τι μᾶλλον ἐξεργάζεσθαι κακόν, εἰ μέλλει μηδεὶς εἰδήσειν ἢ οἱ πάντες ἄνθρωποι· ἀλλ' ἑωυτὸν μάλιστα αἰδεῖσθαι, καὶ τοῦτον νόμον τῇ ψυχῇ καθεστάναι, ὥστε μηδὲν ποιεῖν ἀνεπιτήδειον.*
IV.5.46

D129. *τῶν ἡμαρτημένων ἄνθρωποι μεμνέαται μᾶλλον τῶν εὖ πεποιημένων. καὶ γὰρ δίκαιον οὕτως· ὥσπερ γὰρ τὸν τὰς παρακαταθήκας ἀποδίδοντα οὐ χρὴ ἐπαινεῖσθαι, τὸ δὲ μὴ ἀποδίδοντα κακῶς ἀκούειν καὶ πάσχειν, οὕτω καὶ τὸν ἄρχοντα. οὐ γὰρ ἐπὶ τουτῷ ᾑρέθη ὡς κακῶς ποιήσων, ἀλλ' ὡς εὖ.*
IV.5.47

D130. *οὐδεμία μηχανὴ τῷ νῦν καθεστῶτι ῥυθμῷ μὴ οὐκ ἀδικεῖν τοὺς ἄρχοντας, ἢν καὶ πάνυ ἀγαθοὶ ἔωσιν. οὐδενὶ γὰρ ἄλλῳ ἔοικεν ἢ ἑωυτῷ τὸν <...> αὐτὸν ἐφ' ἑτέροισι γίγνεσθαι· δεῖ δέ κως οὕτω καὶ ταῦτα κοσμηθῆναι, ὅκως ὁ μηδὲν ἀδικέων, ἢν καὶ πάνυ ἐτάζῃ τοὺς ἀδικέοντας, μὴ ὑπ' ἐκείνους γίγνεσθαι, ἀλλά τις ἢ θεσμὸς ἤ τι ἄλλο ἀμυνεῖ τῷ τὰ δίκαια ποιεῦντι.*
IV.5.48

D125. One should assist to the best of one's ability those who are suffering wrong and not overlook it; to do so is right and good, not to do so is wrong and bad.
IV.5.43

D126. Those who do things which merit exile or imprisonment or who merit a penalty should be condemned and not let off; and if anyone lets them off illegally, deciding for gain or for pleasure, he does wrong and this must be something which grieves his heart.
IV.5.44

D127. He has the greatest share of justice and goodness who administers the greatest offices worthily.
IV.5.45

D128. One should not feel shame before others rather than before oneself, or be more willing to do something bad if no one will know of it than if everyone will. Rather one should feel shame before oneself, and set up this law in one's heart, to do nothing unfitting.
IV.5.46

D129. People remember bad deeds more than good, and rightly so; for just as someone who returns a deposit should not be praised, while one who does not should be reviled and punished, so it should be with a ruler. For he was not chosen for that office to do harm, but good.
IV.5.47

D130. There is no way in the present organization of society not to do wrong to rulers, even if they are exceptionally good. For to none other than himself ... he is himself subject to others [text corrupt]. But things should somehow be arranged so that someone who does no wrong, even if he vigorously prosecutes wrongdoers, does not become subject to them, but some law or other device will protect the person who does right.[14]
IV.5.48

14 For discussion of the translation see commentary 'Ethics and Politics,' pp. 230–1. For various suggested supplementations of the lacuna see Procopé 113b, pp. 30–1.

D131. *φύσει τὸ ἄρχειν οἰκήιον τῷ κρέσσονι.*
IV.6.19

D132. *φόβος κολακείην μὲν ἐργάζεται, εὔνοιαν δὲ οὐκ ἔχει.*
IV.7.13

D133. *τόλμα πρήξιος ἀρχή, τύχη δὲ τέλεος κυρίη.*
IV.10.28

D134. *οἰκέταισιν ὡς μέρεσι τοῦ σκήνεος χρῶ ἄλλῳ πρὸς ἄλλο.*
IV.19.45

D135. *ἐρωτικὴν μέμψιν ἡ ἀγαπωμένη λύει.*
IV.20.33

D136. *γαμβροῦ ὁ μὲν ἐπιτυχὼν εὗρεν υἱόν, ὁ δὲ ἀποτυχὼν ἀπώλεσε καὶ θυγατέρα.*
IV.22.108

D137. *γυνὴ πολλὰ ἀνδρὸς ὀξυτέρη πρὸς κακοφραδμοσίνην.*
IV.22.199

D138. *κόσμος ὀλιγομυθίη γυναικί· καλὸν δὲ καὶ κόσμου λιτότης.*
IV.23.38

IV.23.39 [= Democrates 111]

D139. *τεκτονοτροφίη σφαλερόν· τὴν μὲν γὰρ ἐπιτυχίην ἀγῶνος μεστὴν καὶ φρουτίδος κέκτηται, τὴν δὲ ἀποτυχίην ἀνυπέρθετον ἑτέρῃ ὀδύνῃ.*
IV.24.29
[Cf. **191**.]

D140. *οὐ δοκεῖ μοι χρῆναι παῖδας κτᾶσθαι· ἐνορῶ γὰρ ἐν παίδων κτήσει πολλοὺς μὲν καὶ μεγάλους κινδύνους, πολλὰς δὲ λύπας, ὀλίγα δὲ τὰ εὐθηλέοντα καὶ ταῦτα λεπτά τε καὶ ἀσθενέα.*
IV.24.31

D131. Rule belongs by nature to the superior.[15]
IV.6.19

D132. Fear begets flattery, but has no goodwill.
IV.7.13

D133. Daring begins an action, but luck controls its end.
IV.10.28

D134. Use servants like parts of the body, one for one thing, one for another.
IV.19.45

D135. The beloved frees one from the reproach of love. [Sense uncertain]
IV.20.33

D136. He who is lucky in his son-in-law has found a son, he who is unlucky has lost a daughter into the bargain.
IV.22.108

D137. A woman is much more impetuous in foolish speech than a man.
IV.22.199

D138. Having little to say is an ornament for a woman; and it is a fine thing to be sparing of ornament.
IV.23.38

IV.23.39 [= Democrates 111]

D139. Bringing up children is risky; even with good luck it is full of strife and worry, and bad luck there is not exceeded by any other woe.
IV.24.29
[Cf. **191.**]

D140. I do not think that one should have children; for in having children I see many great dangers and much distress, and few blessings and those meagre and weak.
IV.24.31

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15 See commentary 'Ethics and Politics,' p. 230. The slogan recalls Thrasymachus' definition of justice in Plato's *Republic* as 'the advantage of the superior' (*to tou kreittonos sumpheron*, 338c), by which he means the advantage of those in power.

D141. *ὅτεῳ χρήμη τεά ἐστι παῖδα ποιήσασθαι, ἐκ τῶν φίλων τεύ μοι δοκεῖ ἄμεινον εἶναι. καὶ τῷ μὲν παῖς ἔσται τοιοῦτος, οἷον ἂν βούληται· ἔστι γὰρ ἐκλέξασθαι οἷον ἐθέλει· καὶ ὃς ἂν δοκῇ ἐπιτήδειος εἶναι, κἂν μᾶλιστα κατὰ φύσιν ἔποιτο. καὶ τοῦτο τοσοῦτον διαφέρει, ὅσον ἐνταῦθα μὲν ἔστι τὸν παῖδα λαβεῖν καταθύμιον ἐκ πολλῶν, οἷον ἂν δέῃ. ἢν δέ τις ποιῆται ἀπὸ ἑωυτοῦ, πολλοὶ ἔνεισι κίνδυνοι· ἀνάγκη γὰρ, ὃς ἂν γένηται, τούτῳ χρῆσθαι.*
Diels *χρήμη τεά;* mss. *χρήματα:* Diels *οἷον ἂν δέῃ;* mss. *ὧν ἂν δεῖ*
IV.24.32

D142. *ἀνθρώποισι τῶν ἀναγκαίων δοκεῖ εἶναι παῖδας κτήσασθαι ἀπὸ φύσιος καὶ καταστάσιός τινος ἀρχαίης. δῆλον δὲ καὶ τοῖς ἄλλοις ζῴοισι· πάντα γὰρ ἔκγονα κτᾶται κατὰ φύσιν ἐπωφελείης γε οὐδεμιᾶς εἵνεκα· ἀλλ' ὅταν γένηται, ταλαιπωρεῖ καὶ τρέφει ἕκαστον ὡς δύναται καὶ ὑπερδέδοικε, μέχρι σμικρὰ ᾖ, καὶ ἢν τι πάθῃ ἀνιᾶται. ἡ μὲν φῦσις τοιαύτη πάντων ἐστὶν ὅσσα ψυχὴν ἔχει· τῷ δὲ δὴ ἀνθρώπῳ νομίζον ἤδη πεποίηται, ὥστε καὶ ἐπαύρεσίν τινα γίγνεσθαι ἀπὸ τοῦ ἐκγόνου.*
IV.24.33

D143. *τοῖς παισὶ μάλιστα χρὴ τῶν ἀνυστῶν δατεῖσθαι τὰ χρήματα, καὶ ἅμα ἐπιμέλεσθαι αὐτῶν, μή τι ἀτηρὸν ποιέωσι διὰ χειρὸς ἔχοντες· ἅμα μὲν γὰρ πολλὸν φειδότεροι γίγνονται ἐς τὰ χρήματα καὶ προθυμότεροι κτᾶσθαι, καὶ ἀγωνίζονται ἀλλήλοισιν. ἐν γὰρ τῷ ξυνῷ τὰ τελεύμενα οὐκ ἀνιᾷ ὥσπερ ἰδίῃ οὐδ' εὐθυμεῖ τὰ ἐπικτώμενα, ἀλλὰ πολλῷ ἧσσον.*
IV.26.25

D144. *ἔξεστιν οὐ πολλὰ τῶν σφετέρων ἀναλώσαντας παιδεῦσαί τε τοὺς παῖδας καὶ τειχός τε καὶ σωτηρίην περιβάλεσθαι τοῖς τε χρήμασι καὶ τοῖς σώμασιν αὐτῶν.*
IV.26.26

IV.29.18 [= Democrates 57]

D145. *ὥσπερ ἐν τοῖς ἕλκεσι φαγέδαινα κάκιστον νόσημα, οὕτως ἐν τοῖς χρήμασι τὸ †μὴ προσαρμόσαν καὶ τὸ συνεχές†*
IV.31.49

D146. *χρημάτων χρῆσις ξὺν νόῳ μὲν χρήσιμον εἰς τὸ ἐλευθέριον εἶναι καὶ δημωφελέα, ξὺν ἀνοίῃ δὲ χορηγίη ξυνή.*
IV.31.120

D141. If anyone needs to have a child, it seems to me better that he should choose from his friends' children. That way he will get the sort of child he wants, for he can choose the one he likes; and the one that seems suitable will follow his bidding as far as its nature allows. And this is a great difference, in that he can choose from many the one he prefers, according as he thinks it should be. But if he has one of his own, there are many dangers; for he has to make do with the one that is born to him.
IV.24.32

D142. People think of having children as necessary because of their nature and their long-established constitution. This is clear from the other animals too; they all have young in accordance with their nature, but not for any benefit. But when they are born each one takes trouble to rear them as best it can and fears for them when they are little and grieves if anything happens to them. The nature of all living things is like that. But as far as mankind are concerned the opinion has grown up that there is some advantage to be derived from one's offspring.
IV.24.33

D143. Those who can should as far as possible divide their wealth among their children, and at the same time keep an eye on them, to make sure that they do not do anything foolish when they get their hands on it. For at the same time they become much more thrifty over money and eager to get it, and they compete with one another. For what is spent in common does not hurt so much as what one spends for oneself, nor does profit made in common gladden one so much, but much less.
IV.26.25

D144. One can without much expense bring up one's children and build a wall round them to safeguard their wealth and their persons.
IV.26.26

IV.29.18 [= Democrates 57]

D145. As among sores cancer is the worst disease, so as regards money ... [Text corrupt]
IV.31.49

D146. Using wealth intelligently helps one to be liberal and a public benefactor, but if one does it foolishly it is mere public expense.
IV.31.120

IV.31.121 [= Democrates 78]

D147. *πενίη πλοῦτος ὀνόματα ἐνδείης καὶ κόρου. οὔτε οὖν πλούσιος ὁ ἐνδέων οὔτε πένης ὁ μὴ ἐνδέων.*
IV.33.23

D148. *ἢν μὴ πολλῶν ἐπιθυμέῃς, τὰ ὀλίγα τοι πολλὰ δόξει. σμικρὰ γὰρ ὄρεξις πενίην ἰσοσθενέα πλούτῳ ποιέει.*
IV.33.24, 25

IV.34.58 [= Democrates 108]

D149. *ἅπαντες ἄνθρωποι συνειδήσει τῆς ἐν τῷ βίῳ κακοπραγμοσύνης τὸν τῆς βιοτῆς χρόνον ἐν ταραχαῖς καὶ φόβοις ταλαιπωρέουσι, ψεύδεα περὶ τοῦ μετὰ τὴν τελευτὴν μυθέοντες φόβου.*
IV.34.62
[Cf. **D162**]

D150. *γιγνώσκειν χρεὼν ἀνθρωπίνην βιοτὴν ἀφαυρήν τε ἐοῦσαν καὶ ὀλιγοχρόνιον, πολλῇσίν τε κηρσὶ συμπεφυρμένην καὶ ἀμηχανίῃσιν, ὅκως ἄν τις μετρίης τε κτήσιος ἐπιμέληται καὶ μετρῆται ἐπὶ τοῖς ἀναγκαίοις ἡ ταλαιπωρίη.*
In some mss. *ἢ ταλαιπωρέη*
IV.34.65

D151. *εὐτυχὴς ὁ ἐπὶ μετρίοισι χρήμασιν εὐθυμεόμενος, δυστυχὴς δὲ ὁ ἐπὶ πολλοῖσι δυσθυμεόμενος.*
IV.39.17

IV.39.25 [= **D27**]

D152. *ἀπορίη ξυνὴ τῆς ἑκάστου χαλεπωτέρη· οὐ γὰρ ὑπολείπεται ἐλπὶς ἐπικουρίης.*
IV.40.20

D153. *νόσος οἴκου καὶ βίου ὅκωσπερ καὶ σκήνεος.*
IV.40.21

D154. *ἀλογιστίη μὴ ξυγχωρέειν ταῖσι κατὰ τὸν βίον ἀνάγκαις.*
IV.44.64

IV.31.121 [= Democrates 78]

D147. Poverty and wealth are names for lack and superfluity; so he who lacks something is not rich, nor is he poor who lacks nothing.
IV.33.23

D148. If you do not desire many things, a little will seem much to you; for small desires make poverty as strong as wealth.
IV.33.24, 25

IV.34.58 [= Democrates 108]

D149. Everyone, conscious of their evil-doing in life, troubles their time of life with terrors and fears, telling false tales about the fear after death.
IV.34.62
[Shorter version of **D162**]

D150. One should realize that human life is weak and short and heaped up with all sorts of evils and disasters, so as to aim at moderate acquisition and measure one's trouble against what is necessary.
IV.34.65

D151. Lucky is he who is happy with moderate wealth, unlucky he who is unhappy with great wealth.
IV.39.17

IV.39.25 [= **D27**]

D152. Helplessness on the part of all is worse than individual helplessness; for there is left no hope of assistance.
IV.40.20

D153. There is disease of household and of life, as well as of body.
IV.40.21

D154. It is folly not to run along with the necessities of life.
IV.44.64

D155. *λύπην ἀδέσποτον ψυχῆς ναρκώσης λογισμῷ ἔκκρουε.*
IV.44.67

IV.44.68 [= Democrates 42]

IV.44.69 [= Democrates 46]

D156. *πενίην ἐπιεικέως φέρειν σωφρονέοντος.*
IV.44.70

IV.46.18 [= Democrates 58]

D157. *ἄλογοι τῶν ἀξυνέτων αἱ ἐλπίδες.*
IV.46.19

D158. *οἷσιν ἡδονὴν ἔχουσιν αἱ τῶν πέλας ξυμφοραί, οὐ ξυνιᾶσι μὲν ὡς τὰ τῆς τύχης κοινὰ πᾶσιν, ἀπορέουσιν δὲ οἰκηίης χαρᾶς.*
IV.48.10

D159. *ἰσχὺς καὶ εὐμορφίη νεότητος ἀγαθὰ, γήραος δὲ σωφροσύνη ἄνθος.*
Diels *γήραος δὲ σωφροσύνη*; mss. *γῆρας δὲ σωφροσύνης.*
IV.50.20

D160. *ὁ γέρων νέος ἐγένετο, ὁ δὲ νέος ἄδηλον εἰ ἐς γῆρας ἀφίξεται· τὸ τέλειον οὖν ἀγαθὸν τοῦ μέλλοντος ἔτι καὶ ἀδήλου κρέσσον.*
IV.50.22

D161. *γῆρας ὁλόκληρός ἐστι πήρωσις· πάντ' ἔχει καὶ πᾶσιν ἐνδεῖ.*
IV.50.76

D162. *ἔνιοι θνητῆς φύσεως διάλυσιν οὐκ εἴδοτες ἄνθρωποι, συνειδήσει δὲ τῆς ἐν τῷ βίῳ κακοπραγμοσύνης, τὸν τῆς βιοτῆς χρόνον ἐν ταραχαῖς καὶ φόβοις ταλαιπωρέουσι, ψεύδεα περὶ τοῦ μετὰ τὴν τελευτὴν μυθοπλαστέοντες χρόνου.*
IV.52.40
[Cf. **D149**]

D155. Drive out by reasoning distress which is unconquerable if one's mind is torpid.
IV.44.67

IV.44.68 [= Democrates 42]

IV.44.69 [= Democrates 46]

D156. It shows soundness of mind to bear poverty well.
IV.44.70

IV.46.18 [= Democrates 58]

D157. The hopes of the unintelligent are irrational.
IV.46.19

D158. Those who take pleasure in their neighbours' misfortunes do not realize that fortune is common to all, and are incapable of finding their own enjoyment.
IV.48.10

D159. Strength and beauty are goods of youth, soundness of mind the flower of age.
IV.50.20

D160. The old man was once young, but for the young man it is uncertain whether he will reach old age; so the good which is complete is better than that which is still to come, and uncertain.
IV.50.22

D161. Old age is being totally crippled; it has everything and lacks everything.
IV.50.76

D162. Some people, ignorant of the dissolution of mortal nature, but conscious of their evil-doing in life, trouble their time of life with terrors and fears, inventing false tales about the time after death.
IV.52.40
[Cf. **D149**]

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TESTIMONIA

LEUCIPPUS

LIFE

1. DIOGENES LAERTIUS IX.30

Leucippus of Elea, or of Abdera, according to some sources, or Miletus, according to others. He was a pupil of Zeno.

[The remainder of Diogenes' 'Life' consists of a summary of Leucippus' cosmology; see **77a**.]

2. DIOGENES LAERTIUS X.13

Apollodorus[1] says in his Chronicles that he [i.e., Epicurus] was a pupil of Nausiphanes[2] and Praxiphanes.[3] He himself denies it, and says in his letter to Eurylochus that he was self-taught. And he says that there never even was such a philosopher as Leucippus, as does Hermarchus,[4] whom some, including the Epicurean Apollodorus,[5] report as having been a teacher of Democritus.

3. SIMPLICIUS Commentary on *Physics* 25.2

[Discussing Diogenes of Apollonia] Most of his writings are a jumble, but sometimes he follows Anaxagoras and sometimes Leucippus.

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1 Scholar of the second century BC. His *Chronicles* became a standard source for ancient chronology, including the dates of philosophers and other notable persons.

2 Atomist of the fourth century BC. Texts in DK 75.

3 Peripatetic of the fourth–third centuries BC.

4 Epicurus' successor as head of his school.

5 Epicurean and biographer of Epicurus; second century BC.

4. **a.** CLEMENT *Miscellanies* I.64

Now Parmenides was a pupil of Xenophanes, and Zeno of him, then Leucippus, and then Democritus.

[Continued in **198b**]

b. EUSEBIUS *Praeparatio Evangelica* XIV.17.10

Parmenides; Melissus was a pupil of his, Zeno of his, Leucippus of his, Democritus of his, Protagoras and Nessas[6] of his; Metrodorus[7] was a pupil of Nessas, Diogenes[8] of his, and Anaxarchus[9] of his; Pyrrho[10] was acquainted with Anaxarchus.

5. **a.** Ps-GALEN *History of Philosophy* 3

A pupil of his [i.e., of Zeno's] was Leucippus of Abdera, the first proponent of the theory of atoms. Democritus got the theory from him and developed it further.

b. IAMBLICHUS *Life of Pythagoras* 104

The members of this school, and particularly the earliest, who were contemporaries of Pythagoras and young students of his in his old age, Philolaus and Eurytus ... Leucippus and Alcmaeon.

c. TZETZES *Chiliades* 11.980

Leucippus the pupil of Melissus.

DEMOCRITUS

LIFE

6. DIOGENES LAERTIUS IX.34–45

(34) Democritus the son of Hegisistratus (or of Athenocritus, according to some sources, or Damasippus, according to others) came from Abdera or, as some say, from Miletus. He was taught by some Chaldean[11] sages whom King Xerxes had left with his father as his tutors, when he was

6 Texts in DK 69. Nothing is known of his doctrines.

7 A sceptic: texts in DK 70.

8 Of Smyrna: presumably a sceptic. See DK 71.

9 Of Abdera: a sceptic. The doxographical tradition (see DK 72) records him as reproving the vanity of Alexander the Great with pointed sayings.

10 Of Elis: the founder of the Sceptical School.

11 The Greeks applied the name 'Chaldean' to a Persian (originally Babylonian) priestly caste. Since the members of that caste practised astrology, the name acquired the secondary sense 'astrologer.'

received by him, as Herodotus recounts;[12] from them he learned theology and astronomy while still a child. Afterwards he studied with Leucippus and according to some sources with Anaxagoras, being forty years younger than the latter. Favorinus[13] reports in his *Miscellaneous History* that Democritus said that Anaxagoras' doctrines about the sun and moon were not his own, but ancient doctrines which he had plagiarized, (35) and that he ridiculed his views about the formation of the universe and about mind, out of hostility towards him, since Anaxagoras had not accepted him [sc. as an associate]. So how was he a pupil of his, as some people say?

Demetrius[14] in his work *On People of the Same Name* and Antisthenes[15] in his *Successions* say that he travelled to Egypt to learn geometry from the priests, and to Persia to the Chaldeans, and that he went to the Red Sea. And some say that he associated with the naked sages in India and went to Ethiopia. They say that he was the youngest of three brothers who divided their inheritance, and most sources say that because he needed money to travel, he took the portion that was in cash, which was the smallest, as had been cunningly contrived by the others. (36) Demetrius says that his share was over a hundred talents, all of which he spent. He says that he was so studious that he used to shut himself up in a summer-house in the garden; and once when his father was taking an ox to sacrifice and had tied it up there he did not notice it for quite some time, until his father told him about it when he summoned him to the sacrifice. It appears, he [i.e., Demetrius] says, that when he came to Athens he did not trouble to make himself known, since he was indifferent to his reputation. And he knew Socrates, but was not known by him; 'for I came,' he [i.e., Democritus] says, 'to Athens and no one knew me' [= **D1**].

(37) If *The Rivals in Love* is by Plato,[16] says Thrasyllus,[17] Democritus may be the unnamed participant, besides the people who are arguing about Oenopides and Anaxagoras, who talks to Socrates about philosophy, and to whom Socrates says that the philosopher is like a pentathlete. And

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12 Hdt. VIII.120 tells of Xerxes' having received hospitality at Abdera on his retreat from Greece in 480, but does not mention any citizen of the town by name.

13 From Arles; rhetorician and historian of the first to second centuries AD.

14 From Magnesia; first century BC.

15 From Rhodes; second century BC.

16 This short dialogue is generally considered spurious. There is not the slightest evidence to allow the identification of Socrates' unnamed interlocutor; the fanciful suggestion that it is supposed to be Democritus was no doubt prompted by the description of the latter (reported by Diogenes) as a philosophical pentathlete (i.e., all-rounder).

17 The court astrologer of the Emperor Tiberius, who catalogued the works of Plato and of Democritus; see **40**.

indeed he was a pentathlete in philosophy. For he worked on physics and ethics, mathematics and popular writings, and had all sorts of experience in practical crafts. His is the saying 'The word is the shadow of the deed' [= **D31**]. Demetrius of Phalerum[18] says in his *Defence of Socrates* that Democritus never even came to Athens. That is all the more remarkable, if he neglected a city of such importance, not wishing to acquire a reputation from a place, but preferring to confer a reputation on a place.

(38) It is also clear from his writings what sort of person he was. He seems, says Thrasyllus, to have been an adherent of the Pythagorean doctrines; and indeed he refers to Pythagoras himself, expressing admiration of him in his book of the same title [see **40** (46) I]. He appears to take all his views from him, and would even appear to have been his pupil, did not chronology make that impossible. But Glaucus of Rhegium,[19] who lived about the same time, says that he had all his teaching from one of the Pythagoreans, and Apollodorus of Cyzicus[20] says he was an associate of Philolaus.[21]

He used, says Antisthenes, to examine his ideas very minutely, sometimes living alone, or among the tombs. (39) He [i.e., Antisthenes] also says that on his return from his travels he lived in extreme poverty, as he had used up all his wealth, and because of his lack of means he was kept by his brother Damasus. He became famous through predicting some future events, and thereafter was generally revered as someone divinely inspired. There was a law to the effect that someone who had spent his inherited wealth should not be allowed burial in his homeland, and Antisthenes says that, realizing that and wishing to forestall any accusation from his enemies, he read them his *Great World-System* [see **40** (46) III], the most important of all his writings,[22] and that he was awarded five hundred talents, and not only that, but had bronze statues erected to him; and on his death, at the age of over a hundred years, he was given a public funeral. (40) Demetrius says that his relatives read the *Great World-System*, and that the award was only a hundred talents; Hippobotus[23] says the same.

Aristoxenus[24] says in his *Historical Notes* that Plato wanted to burn as many of the writings of Democritus as he could collect, but was persuaded

18 Politician and philosopher; fourth century BC.

19 Historian of philosophy and music, active about 400 BC.

20 Unknown.

21 Pythagorean; fifth century BC.

22 The story is also told by Athenaeus, *Deipnosophistai* IV.168b.

23 Historian of philosophy; third century BC.

24 Philosopher, musical theorist, and historian; fourth century BC. He expected to succeed Aristotle as head of the Lyceum, but was passed over in favour of Theophrastus.

by the Pythagoreans Amyclas and Cleinias that it was useless, as the books were already in wide circulation. This is clear; for Plato, who mentions practically all the early philosophers, never mentions Democritus at all, even in places where he ought to reply to him.[25] He plainly realized that he would be disputing with the best of the philosophers. Timon[26] praises him in these words:

> Among the first I saw the wise Democritus,
> Shepherd of tales and many-sided chatterbox.

(41) Regarding his dates,[27] he was, as he himself says in the *Great World-System*, young in the old age of Anaxagoras, being forty years younger than he. And he says that the *Lesser World-System* was written seven hundred and thirty years after the capture of Troy.[28] He would have been born, acording to Apollodorus in the *Chronicles*, in the 80th Olympiad [460–457 BC], or, as Thrasyllus says in his book entitled *Prolegomena to the Works of Democritus*, in the third year of the 77th Olympiad [470/69 BC], being a year older than Socrates.[29] He would have been a contemporary of Archelaus[30] the pupil of Anaxagoras and of the school of Oenopides;[31] for he mentions the latter. (42) He also mentions the doctrine of the One of Parmenides, Zeno, and their followers (whom he describes as very celebrated contemporaries), and Protagoras of Abdera, who is acknowledged to have been a contemporary of Socrates.

Athenodorus[32] says in the eighth book of his *Discourses* that once, when Hippocrates came to him, he told him to bring some milk, and when he had inspected it he told him that it was from a black goat which had borne its first kid; so that Hippocrates was astonished at his acuity. Hippocrates

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25 Cf. Diogenes Laertius III.25.

26 Sceptical philosopher and poet; fourth to third centuries BC. His poems included lampoons on philosophers of other schools, from one of which the quoted lines are evidently taken.

27 See commentary 'Life and Works,' p. 158.

28 Traditionally dated to the twelfth century BC, but the variations between the dates given by different authorities were sufficiently wide to allow the dating of Democritus' work to be as early as the middle of the fifth century, or as late as the end. Since we know neither which date Democritus assumed for the fall of Troy, nor whether the figure of 730 years actually comes from him, rather than from some chronologer, this piece of information has no independent value.

29 Cf. Aulus Gellius XVII.21.18.

30 Philosopher, fifth century BC; said to have taught Socrates. Texts in DK 60.

31 Mathematician and astronomer; fifth century BC.

32 Philosopher; first century BC.

was accompanied by a girl, and on the first day Democritus greeted her with the words 'Greetings, maiden,' and the next day with 'Greetings, woman,' and indeed the girl had been seduced during the night.

(43) Democritus died, according to Hermippus,[33] in this way. He was already very old and on the point of death. His sister was upset because he was going to die on the day of the festival of the Thesmophoria,[34] which would prevent her from performing her service to the goddess. He told her not to worry, but to bring him warm loaves each day; and by applying them to his nostrils he lasted out the festival. And when the festival days, three in all, were over, he breathed his last without any suffering, at the age, as Hipparchus reports, of a hundred and nine years. I have written about him as follows in my *Verses in all Kinds of Metre*:

> Who was so wise, who e'er did such a deed
> As versatile Democritus achieved?
> Three days he kept Death as his guest at home
> And entertained him with warm breath of loaves.

Such was his life.

(44) His doctrines are as follows. The principles of everything are atoms and void, and everything else is conventional. There are infinitely many worlds which come into being and pass away. Nothing comes into being from what is not, or passes away into what is not. The atoms are infinite in size[35] and number, and they are carried about in the whole in a swirl, and in that way they generate all the compounds, fire, water, air, earth. For these things too are complexes of atoms, which are incapable of being affected and changeless because of their solidity. The sun and moon are compounded of smooth, round bodies of that kind, as is the soul; which is the same as the mind. We see through the impact of images. (45) Everything comes to be by necessity, the swirl, which he calls necessity, being the cause of the coming to be of everything. The end is cheerfulness, which is not the same as pleasure, as some mistakenly took it, but a state in which the soul exists calmly and stably, not disturbed by any fear or superstition or any other emotion. He calls it 'well-being' and many other names. Conventions are artificial,[36] atoms and void by nature.

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33 Biographer; third century BC. He specialized in sensational deathbed scenes.

34 A festival of the goddess Demeter, celebrated by women. A death in the family would make a participant ill-omened, thereby disqualifying her from taking part.

35 See commentary 'Differentiating Properties of Atoms,' p. 175, n. 8.

36 Translating the ms. text *poiēta de nomima*. DK adopts Zeller's emendation *poiotētas de nomōi*, 'qualities exist by convention.'

Those were his doctrines.
[For List of Works (= paras. 46–9) see **40**.]

7. SUIDAS

Democritus son of Hegesistratus (some say of Athenocritus or of Damisippus), born at the same time as the philosopher Socrates in the 77th Olympiad [472–469] (some say in the 80th [460–457]). From Abdera in Thrace, philosopher, according to some sources pupil of Anaxagoras and Leucippus, and also, some say, of Persian magi and Chaldeans [see n. 11]; for he went to Persia, India, and Egypt and learned their wisdom. Then he came back and lived with his brothers Herodotus and Damastes. He held office in Abdera, being highly regarded for his wisdom. His pupil Metrodorus of Chios[37] became famous, and his pupils in turn were Anaxarchus[38] and Hippocrates the doctor. Democritus was nicknamed Wisdom and Laugher, because he laughed at the empty aspirations of mankind. His genuine books are two, the *Great World-System* and *On the Nature of the World*. He also wrote letters.

8. THEODORETUS *Cure for the Ills of the Greeks* IV.9 [= AETIUS 1.3.16]

Democritus of Abdera the son of Damasippus introduced the theory of the void and the solids.

9. a. AULIUS GELLIUS *Attic Nights* XVII.21.18

About that time [late fifth century BC] Sophocles and then Euripides were renowned and celebrated as tragic poets, Hippocrates as a doctor, and Democritus as a philosopher. Socrates the Athenian was younger than they, but they lived around the same time.

b. EUSEBIUS. [From the version of Cyril of Alexandria]

i) They say that in the 70th Olympiad [500–497] there were born the natural philosophers Democritus and Anaxagoras, and also Heraclitus, called 'The Dark.'

ii) They say that Democritus of Abdera, Empedocles, and Hippocrates were alive [i.e., were active] in the 86th Olympiad [436–433]. [The Armenian version gives the date as 435 BC.]
[Different versions give the date of Democritus' death as follows:

Cyril	94th Olympiad [404–401]
Jerome	401

37 See n. 7.

38 Atomist, teacher of Pyrrho, the founder of Scepticism [see **198b**]; fourth century BC.

Armenian	403
Paschal Chronicle	359 BC Democritus dies aged 100.]

10. DIODORUS SICULUS XIV.11.5

About the same time [404 BC] Democritus the philosopher died at the age of ninety.

11. **a.** Ps-LUCIAN *Long-lived People* 18

Democritus of Abdera died from abstaining from food at the age of a hundred and four.

b. CENSORINUS *De Die Natali* 15.3.

They also say that Democritus of Abdera and Isocrates the orator nearly reached the same age as Gorgias of Leontini, who is agreed to have attained the greatest age of any of the ancients, one hundred and eight years.

[Cf. CICERO *Cato* 7.23; SEXTUS *Against the Mathematicians* VII.321; ST JEROME *Letter* 52.]

12. ARISTOTLE *Meteorology* 365a17–19

This was maintained by Anaxagoras of Clazomenae and before him by Anaximenes of Miletus, and after them by Democritus of Abdera.

13. SEXTUS *Against the Mathematicians* VII.389

... Democritus and Plato taught in opposition to Protagoras.

[Context supplied in **181**]

14. **a.** ATHENAEUS *Deipnosophistai* VIII.354c

In the same letter Epicurus says that Protagoras the sophist was formerly a porter and wood-carrier, who first of all became Democritus' secretary. He attracted the latter's attention by an ingenious method of making up bundles of wood, and from that beginning he was taken up by him; he first taught in a village school, and then went on to become a sophist.

[Cf. AULUS GELLIUS *Attic Nights* V.3.]

b. DIOGENES LAERTIUS X.8

[Epicurus said that] Protagoras was Democritus' secretary and taught in a village school.

c. PHILOSTRATUS *Lives of the Sophists* 10

Protagoras the sophist of Abdera was a pupil of Democritus at home, and associated with the magi from Persia at the time of Xerxes' invasion of Greece.

d. DIOGENES LAERTIUS IX.50

Protagoras was a pupil of Democritus.

e. SCHOLIAST on Plato, *Republic* 600c (from HESYCHIUS ?)

Protagoras, son of Artemon, from Abdera. He was a porter, and turned to philosophy on making the acquaintance of Democritus.[39]

15. SUIDAS

Hippocrates ... He was a pupil first of his father, then of Herodicus of Selymbria[40] and Gorgias of Leontini the orator and philosopher, and, as some say, of Democritus of Abdera, whom he met as a young man when he [i.e., Democritus] was old. And also, as some say, of Prodicus.[41]

16. SUIDAS

Diagoras[42] ... he was a slave whom Democritus, seeing his intelligence, bought for ten thousand drachmae and made his pupil. ... Now he was active in the 78th Olympiad [468–465].

17. VALERIUS MAXIMUS VIII.7

He [i.e., Democritus] lived in Athens for very many years, but spent every moment in thinking out and applying his doctrines, so that he was unknown in that city, as he testifies himself in one of his books. [Cf. **D1**.]

18. STRABO *Geography* XV.703 [citing MEGASTHENES, a geographer and historian of the fourth to third centuries BC]

He says that in the mountainous country [sc. of India] there is a river Sila, on which nothing floats. Democritus, who travelled extensively in Asia, denies this, as does Aristotle.

19. CICERO *De Finibus* V.19.50

What should I say about Pythagoras, Plato, and Democritus? We see that they travelled to the ends of the earth from a desire for learning. [Cf. CICERO *Tusculan Disputations* IV.19.44.]

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39 As Protagoras' most probable dates are c. 490–c. 420, it is very unlikely that there is any truth in these stories of his having been educated by Democritus. They are likely to have arisen from the desire to fabricate some association between the two great figures from Abdera, and may also reflect some tradition about the humble origins of great men [cf. **16**]. See Sedley 128.

40 A celebrated doctor of the fifth century BC.

41 A sophist, contemporary with Protagoras and Socrates.

42 Of Melos. A lyric poet of the fifth century BC, notorious as an atheist.

LEGENDS

20. a. PHILO *On Providence* II.13 [What is here translated is the Latin translation, by a nineteenth-century editor, of an Armenian version. The Greek original is lost.]

Democritus was another who, though rich and possessed of much wealth, coming as he did from a noble family, was given over to the desire for wisdom above all, and put a check on that blind and hateful opulence which is usually a mark of the base and depraved; instead he sought that wealth which is not blind, but is reliable, since it is an attribute of the good alone. Therefore he was thought to be overthrowing all the laws of his country, and was looked on as a sort of evil spirit, to such an extent that he was in danger of being deprived even of burial by a law in force in Abdera which prescribed that the body of someone who had not observed the laws of the country should be cast out unburied. That would indeed have happened to Democritus, had he not secured pardon though the good will of Hippocrates of Cos; for they were rivals in the pursuit of wisdom. Further, of his most famous works the one called the *Great World-System* was valued at a hundred Attic talents, or three hundred more according to some accounts.

b. ATHENAGORAS *Embassy on Behalf of the Christians* 31

Democritus was accused of madness and exiled.

[Cf. SENECA *Letters* 79.14.]

21. PHILO *On the Contemplative Life* 49.12

The Greeks celebrate Anaxagoras and Democritus because, struck by the desire for philosophy, they allowed their wealth to be eaten up by sheep. [See also CICERO *De Finibus* V.29.87 (= **188b**), *Tusculan Disputations* V.39.115, *De Oratore* III.15.56; DIO CHRYSOSTOM 54.2; HORACE *Epistles* I.12.12–13; SENECA *On the Blessed Life* 27.5.]

22. AELIAN *Miscellaneous History* IV.20

There is a story that Democritus of Abdera was wise in other respects, and had a particular desire to live in obscurity, which he put into effect with vigour. So he travelled to the Chaldeans and to Babylon[43] and to the magi and to the sages of India. The wealth of his father Damasippus was divided into three among the three brothers, and he took only the cash to pay for his journeys and left the rest to his brothers. Therefore Theophrastus praises him for having accumulated on his travels more than Menelaus and Odysseus. For their wanderings were no different from those of Phoenician

43 See Clement *Miscellanies* I.15.69 (= DK 68 B299).

traders; they were gathering wealth, and that was the aim of their travelling and voyaging.

[According to the same story] the people of Abdera called Democritus 'Philosophy' and Protagoras 'Reason.' And Democritus used to laugh at everyone and say they were mad, and so his fellow citizens also used to call him 'Laugher.' And they say that on first meeting him Hippocrates formed the impression that he was mad, but as he got to know him he came to admire him intensely. And they say that though Hippocrates was a Dorian he wrote his works in Ionic dialect to oblige Democritus.[44]
[Cf. VALERIUS MAXIMUS VIII.7; SENECA *On Providence* 6.2]

23. PLINY *Natural History* XVIII.68.273

It is said that Democritus was the first to understand and demonstrate the affinity between earth and the heavens. The richest of his fellow citizens laughed at that interest of his, but he foresaw from the growth of the shoots (I have explained the reason and shall expound it more fully) that oil was going to be very dear, and bought up all the oil in the district at a time when the price was very low because of the expectation of a bumper olive crop, to the astonishment of all those who knew his poverty and his concern above all to have peace and quiet for his studies. And when it turned out as he had said, and he had become immensely rich, he repaid the money to those worried, grasping landowners (who now regretted their attitude) content thus to have proved that he could easily have wealth whenever he wished.

24. PLUTARCH *Convivial Questions* I.10.2, 628b–d

It will be no bad thing if love of inquiry does for us what it did for the learned Democritus. It seems that he was once eating a cucumber, and noticing that it tasted of honey he asked the maidservant where she had bought it. She mentioned a garden, and he got up and told her to take him and show him the place. The woman was surprised and asked him what he wanted. 'I have to find out the cause of the sweetness,' he said 'and I shall find it out by seeing the place.' The woman smiled and said 'Sit down; I put the cucumber by mistake into a jar that had had honey in it.' 'You've ruined it,' he said, apparently in anger, 'but all the same I shall pursue the inquiry and investigate the cause,' as if the sweetness belonged naturally to the cucumber.

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44 The story that the people of Abdera sent for Hippocrates to treat Democritus' supposed madness, and the account of the subsequent association between the two sages, are set out in nos. 10–23 of the fictional letters preserved in the Hippocratic corpus (*Works of Hippocrates*, ed. Littré, vol. IX). Cf. Soranus, *Life of Hippocrates* 1–3 (Westermann, *Biographi Graeci Minores*). For fuller information see Salem 15, ch. 8.

25. CLEMENT *Miscellanies* VI.32

Democritus was nicknamed Wisdom because of the many predictions he made from observation of the heavens. His brother Damasus looked after him kindly, and once from his observations of the stars he predicted heavy rain. They believed him and brought in the crops (though it was still summer, not yet threshing-time), but the others lost everything when a sudden, unexpected storm broke.

[Cf. PLINY *Natural History* XVIII.78.341.]

26. PHILOSTRATUS *Life of Apollonius* VIII.7.8

What wise man do you think would shun a contest on behalf of such a city, remembering that Democritus once delivered the people of Abdera from famine, and bearing in mind Sophocles of Athens, who is said to have charmed unseasonable winds?

27. JULIAN *Epistles* 201

It is said that Democritus, being unable to console Darius for the death of his beautiful wife, promised to bring her back from the dead, if the king was willing to provide everything necessary. When he told him to spare nothing which he possessed, Democritus reaffirmed his promise, and then after a little said that everything necessary had been supplied, except one thing which he could not provide, but which Darius, the king of all Asia, could no doubt find without difficulty. And when Darius asked what this thing was which it was granted only to the king to know, Democritus said that if he could inscribe on his wife's tomb the names of three people who knew no grief, she would immediately return to life, constrained by the nature of the spell. And when Darius, after long pondering, was unable to find anyone who had not suffered some misfortune, Democritus laughed in his characteristic way and said 'Why then, most foolish of men, do you grieve just as if you alone had such sorrow, when you cannot find one who has ever lived who is without his own grief?'

28. PHILOSTRATUS *Life of Apollonius* VIII.7.14

Democritus laughs at all human affairs

[Cf. CICERO *De Oratore* II.58.235; HORACE *Epistles* II.1.194; JUVENAL X.33–4, 47–50; LUCIAN *The Sale of Lives* 13; SENECA *On Anger* II.10.5, *On Tranquillity of Mind* 15.2; STOBAEUS III.20.53 (quoting SOTION, first century AD philosopher).]

29. CICERO *Tusculan Disputations* V.39.114

Democritus, having lost his sight, could not distinguish white from black; but he could certainly tell good from bad, just from unjust, useful

from useless, great from small, and could live happily without any variety of colours, but not without understanding of things. This man thought that the acuity of the mind was actually hindered by the gaze of the eyes, and when others often failed to see what was before their feet, he used to journey on to infinity, stopping at no boundary.

30. AULUS GELLIUS *Attic Nights* X.17.1

It is written in the records of Greek history that the philosopher Democritus, a man of ancient authority, venerable above others, voluntarily deprived himself of the sight of his eyes, because he considered that the thoughts and reflections of his mind would be more vigorous and exact in contemplating the rational construction of nature if he had freed them from the allurements of sight and the hindrances of the eyes.

31. TERTULLIAN *Apologeticus* 46

Democritus blinded himself because he could not look at a woman without lust and was distressed if he could not have her; by his remedy he confesses his intemperance.

32. PLUTARCH *On Curiosity* 12, 521d

There is no truth in the story that Democritus voluntarily destroyed his eyesight by staring into burning glasses and receiving their reflection, so that his eyes should not disturb his thought by constantly calling it outside, but should let it stay indoors to consider abstract things, like shuttered windows overlooking a street.

33. HIMERIUS *Selections* 3.18

Democritus was voluntarily sick in body, so as to be healthy for higher things.

34. LUCRETIUS III.1039–41

Then when ripe old age warned Democritus that his powers of memory were fading, of his own free will he offered himself to death.

35. ANONYMUS LONDINENSIS[45] 37.34ff

And there he [i.e., Asclepiades, a first century BC medical writer] says that there is a story that Democritus had fasted for four days and was on the point of death when some women begged him to remain alive for a few days,

45 A medical papyrus in the British Museum, believed to date from the first century AD.

so that the Thesmophoria, which were then being celebrated, should not be spoiled by an ill omen.[46] He told them to go away, and sat by the loaves which were being baked so that the vapour blew on him. And Democritus regained his strength by inhaling the vapour from the oven, and so lived on for the remaining time.
[Cf. CAELIUS AURELIANUS *Acute Diseases* II.37.]

36. ATHENAEUS *Deipnosophistai* II.46e

The story goes that Democritus of Abdera had decided to end his life because of his great age and was abstaining from food every day. Since the days of the Thesmophoria were near, and the women of his family begged him not to die during the festival, so that they could take part, he agreed and ordered a jar of honey to be placed beside him, and lived for the required number of days on nothing more than the exhalation of the honey. And after that time the honey was removed and he died. Democritus was always fond of honey, and when someone asked him how to keep healthy he said 'Moisten the inside with honey and the outside with oil.'

37. MARCUS AURELIUS *Meditations* III.3
Lice killed Democritus.

WORKS

38. SUIDAS
His genuine books ... letters. [From **7**]

39. a. SUIDAS From entry under 'Callimachus,'[47] listing the latter's writings.

Glossary[48] and list of writings of Democritus

b. STEPHANUS OF BYZANTIUM p. 640.5

Hegesianax,[49] grammarian, wrote a book on the diction of Democritus and one on poetic diction. He came from the Troad.

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46 Cf. **6** (43), with n. 34.

47 Poet and literary historian; fourth to third centuries BC.

48 West 23 proposes to read *gnōmōn* instead of *glossōn*, giving 'List of sayings and writings of Democritus.' O'Brien 21 defends the traditional reading, pointing to the ancient evidence of Democritus' use of unfamiliar words. See note at end of section 'Literary Criticism and Theory of Language,' p. 138 below.

49 Probably early second century BC.

40. DIOGENES LAERTIUS IX.45–9 (continuing **6**)

Thrasyllus listed his works, arranging them in tetralogies as with the works of Plato.

(46) Ethics

I. 1. Pythagoras. 2. The Disposition of the Sage. 3. The Things[50] in Hades. 4. Tritogeneia[51] (that means that she [i.e., Athena] produces three things which sustain everything human).

II. 1. On the Goodness of Man or On Excellence. 2. The Horn of Amaltheia. 3. On Cheerfulness. 4. Ethical Notes (Well-being is not extant). These are the ethical works.

Natural Science

III. 1. Great World-System (which the school of Theophrastus attributes to Leucippus). 2. Lesser World-System. 3. Description of the World. 4. On the Planets.

IV. 1. On Nature, Book I. 2. On the Nature of Man (or On Flesh), Book II. 3. On the Mind. 4. On the Senses (some authorities count the latter two as one book, entitled On the Soul).

V. 1. On Tastes. 2. On Colours. (47) 3. On the Different Shapes. 4. On Changes of Shape.

VI. 1. Confirmations[52] (which is critical of what has previously been said). 2. On Images or On Forethought. 3. Canon of Logic, 3 books. 4. Problems. These are the works on nature.

Miscellaneous

1. Celestial Causes. 2. Causes in the Air. 3. Terrestrial Causes. 4. Causes of Fire and of the Things in Fire. 5. Causes of Sounds. 6. Causes of Seeds, Plants, and Fruits. 7. Causes of Animals, 3 books. 8. Miscellaneous Causes. 9. On the Stone. These are the Miscellaneous Works.

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50 Or perhaps 'The Souls in Hades.'

51 'Tritogeneia' (literally, 'born of Trito') was an epithet of the goddess Athena, whose sense was variously explained. The book was presumably about the various crafts of which Athena was the patroness, including spinning and weaving, pottery, and the cultivation of the olive. The reference to three (*tria*) things indicates a pun on the epithet.

52 'Confirmations' renders the Greek *kratuntēria*, a noun formed from the verb *kratunō*, meaning to strengthen, establish, or control. Hence the title literally means either 'means of strengthening' or 'means of controlling.' Understood in the former way it was presumably the title of a work devoted to strengthening Democritus' own doctrines, by means of criticism either of his own previous pronouncements, or of the work of his predecessors, or of both. If the title is taken in the latter way, the work was presumably critical of others. Cf. **179a**.

Mathematics

VII. 1. On Difference of Judgement or On the Contact of Circle and Sphere.[53] 2. On Geometry. 3. Topics in Geometry. 4. Numbers.

VIII. 1. On Irrational Lines and Solids, 2 books. 2. Things Unfolded. (48) 3. The Great Year or Astronomy, a calendar. 4. The Contest of the Water-Clock.[54]

IX. 1. Description of the Heavens. 2. Description of the Earth. 3. Description of the Poles. 4. Description of Rays. These are the mathematical works.

Music

X. 1. On Rhythm and Melody. 2. On Poetry. 3. On Beauty of Diction. 4. On Euphonious and Cacophonous Letters.

XI. 1. On Homer or On Correct Diction and Words. 2. On Song. 3. On Words. 4. On Names. These are the musical works.

Technical Works

XII. 1. Prognosis. 2. On Diet or Dietetics. 3. Medical Opinion. 4. Causes of Suitable and Unsuitable Times.

XIII. 1. On Agriculture or Land-Measurement. 2. On Painting. 3. Tactics and Use of Arms. That is all under this heading.

Some authorities list separately the following titles from the Notes.

(49) 1. On the Sacred Writings in Babylon. 2. On the Things in Merope. 3. Voyage Round the Ocean. 4. On History. 5. Chaldean Treatise. 6. Phrygian Treatise. 7. On Fever and Coughs. 8. Causes of Laws. 9. Problems of Handicrafts [conjectural reconstruction of ms. corruption].

The other works attributed to him by various sources are either compilations from his writings or acknowledged to be spurious. This is the total of his works.

STYLE

41. a. CICERO *De Oratore* I.11.49

If that scientist Democritus spoke eloquently, as is reported and as I myself think, the subject-matter he spoke of was appropriate to a scientist, but he himself is to be reckoned as adorned with the words of an orator.

b. CICERO *Orator* 20.67

Whatever falls into an audible measure, though distinct from verse (which is indeed a fault in a speech) is called 'number,' or in Greek 'rhythm.'

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53 On the text and interpretation of this title, see commentary 'Science and Mathematics,' p. 199.

54 Conjectural title. The mss. contain the words 'contest' and 'water-clock' (or 'pipette,' Greek *klepsydra*) in an ungrammatical construction.

So I observe that the diction of Plato and Democritus, though distinct from verse, is yet considered by some, on account of its intense drive and the striking beauty of the language, to be more genuine poetry than the verse of comic poets.

c. CICERO *De Divinatione* II.64.133

Heraclitus is extremely obscure, Democritus hardly at all.

d. DIONYSIUS OF HALICARNASSUS *De Compositione Verborum* 24

[Listing leading exponents of the 'middle' style] And among the philosophers, in my opinion, Democritus, Plato, and Aristotle; for it would be hard to find anyone better than these at blending their diction.

THE DOCTRINES OF THE ATOMISTS

[The lists of titles preserved by Diogenes Laertius and others show that Democritus was discussed by numerous writers, including Aristotle (who devoted two works to him, *Against Democritus* and two books of *Problems from Democritus*), Theophrastus, Heracleides Ponticus, and Epicurus.]

BASIC PRINCIPLES

42. a. ARISTOTLE *De Generatione et Corruptione* (*GC*) 315a34–315b2; 315b6–15

In general, no one has discussed these matters [i.e., the conditions of coming to be and passing away] other than superficially, with the exception of Democritus. He seems not merely to have thought about them all, but to differ from the rest in his approach.

[Aristotle proceeds to explain the difference of approach as follows. The other philosophers gave no detailed account of coming to be and passing away, whereas (315b6–15)] Democritus and Leucippus posited the shapes[55] and explained alteration and coming to be in terms of them, coming to be and passing away by separation and joining together, alteration by order and arrangement. And since they thought that truth was in appearance, and the appearances were contrary and infinite, they made the shapes infinite, so that through changes in the substrate the same thing appears opposite to one person and to another, and varies as the result of a small additional element and appears wholly different through the variation of a single element; for tragedy and comedy are composed of the same letters.

55 See commentary 'Differentiating Properties of Atoms,' p. 172.

b. PHILOPONUS Commentary on 315b9, 23.1–8

Since, he says, they say that every appearance is true and each thing is at it appears and the same thing often presents opposite appearances to people, Democritus and his followers are able, from their own principles, to preserve the truth of those appearances of the same thing, since they posit an infinite number of shapes of the elements. For as these change their arrangement and alter their position they present now one appearance of the same thing and now another, depending on their relation to the observer and the distance from him.

[Cf. ARISTOTLE *Physics* 187a26–31; PHILOPONUS Commentary on *Physics* 95.12–15, 110.11–12; SIMPLICIUS Commentary on *Physics* 1266.33–6.]

43. a. ARISTOTLE *De Partibus Animalium* (*PA*) 642a24–31

The reason our predecessors did not arrive at this method [sc. of explanation in terms of the nature of a kind of thing] was that they did not have the [concept of] essence and the definition of substance. Democritus was the first to touch on these, not because he thought it necessary to the examination of nature, but because he was constrained by the facts themselves. This method became more common in the time of Socrates, but the investigation of nature declined, and philosophers turned to the study of practical excellence and political philosophy.

b. ARISTOTLE *Metaphysics* 1078b19–21

For among the natural philosophers Democritus merely touched on it [sc. the giving of general definitions] to a small extent, and defined the hot and the cold after a fashion.

[Cf. ARISTOTLE *Physics* 194a18–21.]

c. PHILOPONUS Commentary on *Physics* 228.28–229.2

For Democritus said that matter was the substratum of the atoms and that the formal causes were the shapes of the atoms: spherical atoms were the cause of fire, cubical of water, and other things were caused by other shapes.

[Cf. PHILOPONUS Commentary on *GC* 12.32–13.2, 17.16–18.3; SIMPLICIUS Commentary on *Physics* 300.17–18; THEMISTIUS Commentary on *Physics* 42.11–14.]

44. a. SIMPLICIUS Commentary on *De Caelo* 294.33–295.36

A brief quotation from Aristotle's *On Democritus* will set out their [i.e., the atomists'] view.

'Democritus thinks that the nature of the eternal things consists of small substances infinite in number; these he places in space, separate from them and infinite in extent. He calls space by the following names: "the void," "nothing," and "the infinite," and each of the substances he calls

"thing,"[56] "the solid," and "what is." He thinks that the substances are so small as to escape our senses. They have all kinds of forms and all kinds of shapes and differences of size. Now from these as elements he generates the visible and perceptible bodies. He says that they conflict with one another and travel about in the void because of their unlikeness[57] and the other differences which have been mentioned, and as they travel about they collide and entangle with one another, and that entanglement makes them touch and be near one another, but does not really generate any single nature from them; for it would be quite absurd for two or more things ever to become one. He explains the fact that the substances remain together for some time by the dovetailing and interlocking of the bodies; for some of them are uneven, some hook-shaped, some concave, some convex, the rest with innumerable differences. He thinks that they hang on to one another and remain together until some stronger necessity, approaching from the surroundings, shakes the complex apart and disperses it.'

He says that coming to be and its opposite, separation, occur not only in the case of animals but also in plants and worlds and in general all sensible bodies. Now if coming to be is joining together of atoms, and passing away is separation, according to Democritus too coming to be would be alteration.

b. ARISTOTLE *Metaphysics* 1039a9–11

Democritus is correct in saying that it is impossible for one thing to come to be from two, or two from one; for he posits the atomic magnitudes as the substances.

c. THEMISTIUS Commentary on *Physics* 123.18–20

All of these [i.e., Leucippus, Democritus, Epicurus, and many others] cite the involvement of the void as the cause of the differentiation of the corpuscles, since what is truly continuous is in their view indivisible.

d. THEMISTIUS Commentary on *Physics* 129.8–9

Democritus says that the void is not-being and a privation.

45. SIMPLICIUS Commentary on *Physics* 28.4–27

Leucippus of Elea or Miletus (both are reported) associated in philosophy with Parmenides, but did not follow the same path as Parmenides and Xenophanes about what there is, but, it seems, the opposite. For they made the universe consist of one changeless, ungenerated, and bounded thing and did not admit that one could even think of what is not, while he posited the atoms, an infinite number of elements in continual motion, and held that

56 'Thing' translates *den*, an artificial formation from *ouden*, 'nothing.' On the morphology and sense of the word see Moorhouse 36.

57 See commentary 'Chance and Necessity,' p. 194.

they have an infinite number of shapes, since there is no more reason for them to be one shape than another,[58] and that coming to be and change are unceasing among the things that there are. Further, that which is exists no more than that which is not, and both are alike causes of the things that come to be. For positing the nature of the atoms as solid and a plenum he said that it is what is and that it travels about in the void, which he called 'what is not' and said that it is no less than what is.

Similarly his associate Democritus of Abdera posited as principles the plenum and the void, calling the one 'what is' and the other 'what is not.' They posit the atoms as matter of the things that there are, and generate everything else by their differentiating characteristics. There are three of these, 'rhythm,' 'turning,' and 'contact,' which is to say shape, position and arrangement. For it is natural for like to be affected by like and for things of the same kind to move towards one another[59] and for each of the shapes to be reorganized into a different complex and so make another state. So they claimed that, the principles being infinite, they would readily account for all substances and properties, and what is the cause of anything and how. That is why they say that only those who make their elements infinite can make everything turn out according to their theory. They say that the number of shapes belonging to the atoms is infinite because there is no more reason for them to be one shape than another; for that is the explanation they give of the infinity.

[Cf. ARISTOTLE *GC* 327a16–21; SIMPLICIUS Commentary on *Physics* 522.15–18, 1320.16–19.]

46. a. ARISTOTLE *Metaphysics* 985b4–22

Leucippus and his associate Democritus say that the elements are the plenum and the void, calling the one 'what is' and the other 'what is not,' viz. the plenum and solid 'what is,' and the void and fine-textured 'what is not' (which is why they say that what is is no more than what is not, because the void is no less than body), and these are the material causes of what there is. And just as those who make the underlying substance one generate everything else by means of its properties, positing density and looseness of texture as principles of the properties of things, in the same way they say that the differentiations [sc. of the atoms] are the cause of everything else. Now they say that these are three, shape, arrangement, and position. For they say that what is is differentiated only in 'rhythm,' 'contact,' and 'turning.' 'Rhythm' is shape, 'contact' arrangement, and 'turning' position;

58 See commentary 'Basic Principles,' p. 162.

59 See commentary 'Chance and Necessity,' p. 193.

for A differs from N in shape, AN from NA in arrangement and Z from N in position. But the question of the origin and nature of motion in things they too ignored, just as blithely as the others.

b. ALEXANDER Commentary on the above 36.21–5

He is speaking of Leucippus and Democritus. For they say that the atoms are moved by mutual impact and by banging against one another, but what the natural origin of the motion is they do not say. For motion resulting from mutual impact is violent, not natural, and the violent is posterior to the natural. For they do not even state the cause of weight in the atoms. For the partless elements which they postulate as parts of the atoms have, they say, no weight; but how could weight come into being from the conjunction of weightless things?

c. THEMISTIUS Commentary on *De Caelo* 186.30–3

Those who postulate indivisibles do not say that they are totally small, since there is found in them a principle which admits of notional division into seven parts, but they say that that cannot be divided any further.

[Cf. ARISTOTLE *Metaphysics* 1009a27–30, 1042b11–15, 1069b22, *Physics* 188a22–4; Ps-ARISTOTLE *On Melissus, Xenophanes, and Gorgias* 975b28–30; ALEXANDER Commentary on *Metaphysics* 303.29–304.9; ASCLEPIUS Commentary on *Metaphysics* 33.11–13; EUSEBIUS *Praeparatio Evangelica* XIV.3.7.]

47. a. ARISTOTLE *GC* 314a11–25

Those who make the matter of things more than one must distinguish coming to be from alteration. To this class belong Empedocles, Anaxagoras, and Leucippus. ... Anaxagoras agrees with Leucippus and Democritus that the elements are infinite. ... Democritus and Leucippus say that everything else is composed of indivisible bodies, infinite in number and in [the number of] their shapes, and they [i.e., the compounds] differ from one another in their constituents and in the position and arrangement of those constituents.

b. PHILOPONUS Commentary on the above 12.2–9

Democritus and Leucippus posited indivisible bodies infinite not only in number but in the variety of their shapes, so that it is a consequence of their theories that there is something more infinite than the infinite. The Epicureans ... disagreed with Democritus on this point; they posit the atoms as infinite in number, but as regards shape the varieties are innumerable but not infinite.

[Cf. STOBAEUS I.15.6a (= AETIUS I.14.3).]

48. a. ARISTOTLE *GC* 324b35–326b6

The most systematic and general theory [sc. of the nature of change] was proposed by Leucippus and Democritus, taking as their starting-point

the actual nature of things. For some of the older philosophers[60] thought that what is is necessarily one and motionless; for the void is not, and there could be no motion without a separate void, nor could there be many things if there were nothing to separate them. ... As a result of these arguments they set perception aside, and disregarding it on the ground that one must follow reason they say that the universe is one and motionless, and, some of them add, infinite;[61] for a limit would bound it against the void. ... These things seem to follow logically, but in practice it seems near to madness to think like this; for no madman is so crazy as to think that fire and ice are one and the same, but it is only in the case of what is good and what customarily seems so that some people are mad enough to think that there is no difference between them.

But Leucippus thought that he had a theory which would grant to perception what is generally agreed, and would not do away with coming to be or passing away or motion or the plurality of things. In those respects he agreed with what seems to be the case, but to those who proposed the theory of the One he agreed that there can be no motion without void, and said that the void is not, and that nothing that there is is not; for what really is is a total plenum. But that is not one thing, but infinitely many things, invisible because of their small size. And they move in the void (for there is a void), and they produce coming to be by their combination and passing away by their separation. And they act and are acted on as they happen to come into contact; for in that way they are not one. And they generate by being combined and entangled together. From what is truly one there could never come to be a plurality, nor from what is truly many one thing; that is impossible. But, just as Empedocles and some others say happens by means of the pores, so on this theory all qualitative change and every case in which something is affected come about in this way; dissolution and destruction happen by means of the void, and growth too, when solid bodies are imperceptibly added. ...

On these points it is clear both what they [i.e., the atomists] say and that it is pretty much in agreement with the assumptions which they use. This is less clear in the case of others, e.g., it is not clear how for Empedocles there can be destruction and qualitative change. For the atomists the primary bodies are indivisible, differing only in shape, and they are the primary constituents of things and the ultimate elements into which they are dissolved. ... Plato's theory differs from that of Leucippus to this extent, that the latter says that the indivisibles are solids, the former planes, and the latter says that

60 I.e., the Eleatics.

61 Specifically Melissus; see DK 30 B4.

they have an infinite number of shapes, the former a determinate number; both say that there are indivisibles of determinate shape. Things come to be from these elements and separation occurs according to Leucippus through the void and through contact (for that is how each thing is divided), but according to Plato by contact only; for he says that there is no void.

We have discussed indivisible planes in an earlier work.[62] For the present we may dispense with a more extended examination of the consequences of the postulation of indivisible solids, but, to undertake a brief digression, it is necessary to say that each of the indivisibles is incapable of being affected (for it cannot be affected except through the void) and not productive of any effect – for it is not possible for it to be hard or cold. Yet there is this absurdity, that heat alone is ascribed to the round shape;[63] for it is necessary that the opposite too, cold, should belong to some other shape. And it would also be absurd if those, i.e., heat and coldness, belong to specific shapes, but heaviness and lightness, hardness and softness do not belong; yet Democritus says that each of the indivisibles is heavier in proportion to its greater size, so that it is clear that it will be hotter too. And since they are so, it is impossible that they should not be affected by one another, e.g., a moderately hot one by one which is very much hotter. Moreover, if some are hard, some must be soft too. But now soft is defined in terms of being affected; for what yields is soft. Moreover it is absurd either if nothing belongs to them except shape, or if only one extra property belongs, e.g., hot in one case, cold in another; for then their nature would not be uniform. Similarly it is impossible for more properties to belong to a single one; for being indivisible it will have its properties at the same point, so that if it is affected at one point by being made cold, it will be differently affected, or have a different effect, at the same

62 *De Caelo* III.1 and 7; IV.2

63 In general, the atomists' theory is that all properties apart from the intrinsic properties of the atoms, viz. size, shape, impenetrability, motion, ordering, and arrangement, i) are properties of aggregates, and ii) are such that their characterizing the aggregates is explained by the intrinsic qualities of the atoms. Aristotle argues that the atomists make a unique exception of heat, treating it as an intrinsic property of spherical atoms, and that this exception is arbitrary. It is not clear that he is fair to the atomists. While the evidence is that they believed that fire was an unstable aggregate of spherical atoms (**106a–b**), that is consistent with their holding that heat is a property of aggregates of spherical atoms, not of these atoms individually. Hence there is no reason to accept that their account of heat constituted a departure from their general theory of sensible qualities.

In the remainder of this paragraph Aristotle draws out further consequences, which he alleges to be absurd, of the attribution of sensible properties such as heat to atoms.

point. And similarly with other properties; for those who say that there are indivisible solids or planes arrive at the same result, since it is not possible for them to become rarer or denser, there being no void in the indivisibles. Further, it is absurd for small things to be indivisible, but large ones not. Now indeed it is reasonable that larger things should be more readily broken than smaller, for some things, e.g., large things, are easily dissolved, since they collide with many things; but in general why does indivisibility belong rather to small things than to large? Further, is the nature of all those solids uniform, or do they differ from one another, e.g., some fiery, some earthy in their bulk? If all have a single nature, what separates them? Why do they not become one when they come into contact, as water does when it comes into contact with water?[64] The former case is no different from the latter. If they are of different natures, of what sort are those? It is clear that they should be posited as principles and causes of what results, rather than the shapes. Further, if they differed in nature they would both affect and be affected by contact with one another. Further, what is it that moves them? If it is something else, they are capable of being affected.[65] But if each one moves itself, either it will be divisible, causing motion with respect to one part and being moved with respect to another, or opposites will belong to it with respect to the same part, and its matter will be one not merely numerically but also in potentiality.

b. ARISTOTLE *Physics* 187a1–3

Some gave in to both arguments, conceding to the argument that if being means one thing, everything will be one by positing that what is not exists, and to the argument from dichotomy by positing atomic magnitudes.

49. ARISTOTLE *GC* 315b28–317a17

If there are indivisible magnitudes, are they bodies, as Leucippus and Democritus say, or planes as in the *Timaeus*? This seems irrational, as we have said before, to divide as far as the plane; so it is more reasonable that there should be indivisible bodies, but that too contains a great deal of irrationality. All the same it is possible to have qualitative change and coming to be, as we have said, by varying the same thing in position and arrangement and difference of shape, as Democritus does (which is why he

64 On problems of atomic contact, see commentary 'The Void,' pp. 186–8.

65 On the sense in which atoms were conceived as 'incapable of being affected' see commentary 'Divisibility,' pp. 164–71. What the atomists meant was that atoms could not be split or fused together: they did not disallow atoms' causing other atoms to move, as Aristotle here assumes.

says there is no such thing as colour; things are coloured by the position [sc. of their atoms]), but those who divide things up into planes cannot. ...

Democritus would appear to have been convinced by appropriate arguments, belonging to the nature of the subject-matter. What I mean will become clearer as we proceed.[66] For there is a problem, if one posits a body and a magnitude divisible at every point, and posits this as possible. For what will there be which survives the division? For if it is divisible at every point, and this is possible, it could at one and the same time be divided, even if it has not been divided at one and the same time; and if that were to happen, there would be no impossibility. So if it is divisible at every point, both at the mid-point and generally, nothing impossible will have occurred if it is divided, for even if it were divided into ten thousand parts ten thousand times over, there is no impossibility, though perhaps no one would divide it like that. Now since the body is like that at every point, let it have been divided. What is now left? A magnitude? That is not possible; for it will be something undivided, but it was assumed that it was divisible at every point. But if no body or magnitude is left, but there is a division, either it will be composed of points, and put together from things with no magnitude, or it will be nothing at all, so that even if it could come to be by being put together out of nothing, the whole would be nothing but an appearance. Similarly, if it is composed of points, it will not be a quantity. For when they were in contact and together as one magnitude, they did not make the whole any bigger; for when it is divided into two or more parts the whole is no larger or smaller than before; so that even if they are all put together, they will not make any magnitude. But now if a sort of sawdust results from the division of the body, and a body emerges from the magnitude in this way, the same argument applies; for how is that divisible? And if what results is not a body but some separate nature or property, and the magnitude consists of points or intersections with that property, it is absurd that a magnitude should consist of non-magnitudes. Further, where will the points be, and will they be motionless or in motion? And an intersection is always of two things, so that there is something besides the intersection and the division and the point. Now if anyone posits that any body of whatever kind is divisible at every point, this follows. Further, if, having divided it, I put the piece of wood or whatever back together, it is again one thing, the same size as before. Now clearly this is so if I cut the wood at any point; for it was potentially divided at every point. So what is there

66 On the argument which follows see commentary 'Divisibility,' pp. 164–7.

besides the division? If there is some property, how is it resolved into things of that kind and reconstituted from them? And how are those things separated? So if it is impossible that magnitudes should be composed of points and intersections, there must be indivisible bodies and magnitudes. But on the other hand if we posit them, the consequences are no less impossible, as we have discussed elsewhere.[67] Still we must try to resolve these difficulties, so we must set out the problem from the beginning once again.

That every perceptible body should be both divisible at any point and indivisible is not at all absurd; the former attribute will belong to it potentially, the latter actually. That it should be at one and the same time potentially divisible at every point would appear to be impossible. For if is possible, it could happen (not so as to be actually both indivisible and divided at one and the same time, but divided at every point); so there will be nothing left, and the body will disappear into something incorporeal, and would come into being again either out of points or altogether from nothing. And how is that possible? But surely it is clear that it is divided into separate, ever smaller magnitudes, removed and separated from one another. Now if it is divided piece by piece the breaking up could not go on to infinity, nor can it be divided at one and the same time at every point (for that is not possible), but only so far; so there must exist indivisible magnitudes which are invisible, especially if there is to be coming to be and passing away, occurring by joining together and separation respectively. This is the argument which seems to necessitate the existence of indivisible magnitudes ...

50. a. SIMPLICIUS Commentary on *Physics* 925.10–22

Those who abandoned the idea of cutting to infinity, on the ground that we cannot cut to infinity and so establish the inexhaustibility of cutting, said that bodies are composed of indivisibles and divided into indivisibles. Except that Leucippus and Democritus say that the cause of the indivisibility of the primary bodies is not merely their inability to be affected, but also their smallness and partlessness, whereas Epicurus subsequently denies that they are partless, but says that they are uncuttable because of their inability to be affected. Aristotle criticized the view of Leucippus and Democritus in many places, and it was perhaps because of his criticisms of the doctrine of partlessness that Epicurus, who came later

67 *Physics* VI.1; *De Caelo* III.4 (the latter in **56**).

and supported the view of Leucippus and Democritus about the primary bodies, maintained the position that they are incapable of being affected, but abandoned partlessness, thinking that on that point they had been refuted by Aristotle.

b. Ps-PLUTARCH *Epitome* I.16.2 [= AETIUS I.16.2]

Those who posit the atoms stop at the partless things and say that cutting does not go on to infinity.

c. ARISTOTLE *De Caelo* 271b8–11

[E]ven a small deviation from the truth at the beginning is subsequently magnified ten thousand times over; e.g., if someone were to say that there is a smallest magnitude. In thus introducing the smallest magnitude he overturns the greatest truths of mathematics.

[Cf. SIMPLICIUS Commentary on the above 202.25–203.2, Commentary on *De Caelo* 665.6–9; PHILOPONUS Commentary on *GC* 164.20–2.]

d. SCHOLIAST on Euclid X.1

There is no smallest magnitude, as the Democriteans say.

e. Ps-PLUTARCH *Epitome* I.9.3 [= AETIUS I.9.3]

Democritus and his followers say that the primary things, the atom, the void and what is incorporeal, are incapable of being affected.

f. Ps-PLUTARCH *Epitome* I.9.6 [= AETIUS 1.9.6]

Those who say that matter consists of the partless things and the atoms say that it is formless.

g. ALEXANDER Commentary on *Metaphysics* 355.13–15

According to all these theorists the elements are indivisible in species, but according to those who make the atoms elements they are indivisible in quantity also, not merely in species.

[Cf. ASCLEPIUS Commentary on *Metaphysics* 307.17–18.]

h. SIMPLICIUS Commentary on *Physics* 81.34–82.3

'Indivisible' has various senses: i) what is capable of being divided but has not yet been divided, e.g., every continuous quantity; ii) what is wholly incapable of being divided, in virtue of having no parts into which it could be divided, e.g., a point and a monad; iii) what has parts and size, but is incapable of being divided because of its solidity and fullness, e.g., each of the atoms of Democritus.

i. SIMPLICIUS Commentary on *De Caelo* 609.17–18

Leucippus and Democritus, who call elements things which are indivisible because of their smallness and fullness.

j. EUSEBIUS *Praeparatio Evangelica* XIV.14.5

It is called an atom not because it is the smallest thing, but because it cannot be cut, since it cannot be affected and contains no void.

51. a. ARISTOTLE *Physics* 184b20–21

[Aristotle is setting out various views on the number of principles of change.] If they are infinite, then either they must be as Democritus holds, one in kind, but different in shape, or else different in species, or even opposite.

b. ARISTOTLE *Physics* 203a19–b2

Those who make the elements infinite, like Anaxagoras and Democritus, the former making them of things whose parts are of the same kind as the whole, the latter with his generative mixture of all kinds of shapes, say that the infinite is continuous in contact.[68] ... Democritus says that none of the primary things come into being from one another, but all the same in his view the first principle of all of them is their common body, which is distributed in different sizes and shapes.

c. GALEN *On the Elements According to Hippocrates* I.2

One could say that everything is one in nature and in power, as Epicurus, Democritus, and their followers say of the atoms.

52. a. ARISTOTLE *De Caelo* 275b29–276a1

If the universe is not continuous, but, as Leucippus and Democritus say, differentiated by the void, it is necessary that everything should have a single motion. For they are differentiated by their shapes, but they say that they have a single nature, as if each one were a separate piece of gold.

b. ARISTOTLE *Physics* 213a31–b22

Now [in order to show that there is no void] one has to show that there is no intervening space between bodies, nothing actual and separate, which separates all bodies so that they are not continuous, as Leucippus and Democritus and many other theorists of nature say, or even that there is something outside the totality of continuous body.

[Those who maintain that there is void] say first that otherwise spatial motion would not occur (and this consists of locomotion and growth); for it does not seem that there would be motion, if there were no void, for it is impossible that what is full should admit anything else. If it did admit it, and there were consequently two things in the same place, then any number of bodies could be in the same place at the same time; for it is impossible to specify the difference which would exclude that consequence. And if that is possible, then the smallest thing could contain the largest; for a large thing is equal to many small things. So if it is possible for many things of equal size to be in the same place, it is equally possible for many things of unequal size

68 In describing the totality of Democritus' atoms as constituting a continuous whole Aristotle appears to overlook the separation of the atoms by the void (see **52**).

to be. ... That is one argument for the existence of void, and another is from the fact that some things appear to combine and condense, e.g., wine-jars hold skins along with wine, when the body which is condensed enters into the empty spaces in the other. Further, everyone thinks that growth occurs by means of void; for nourishment is a body, and it is impossible for two bodies to be in the same place at the same time. As evidence they cite the fact that a container holds as much water when it has ashes in it as it does when empty.[69]

c. SIMPLICIUS Commentary on *Physics* 213a22–b4; 648.11–15

They [i.e., those who accept an actual void] said that there actually is such a distance which exists between objects and prevents them from being continuous, e.g., Leucippus and Democritus and their followers, who say that there is void not merely within the cosmos, but outside as well. Clearly that would not be place, but something that exists of itself.

d. ARISTOTLE *Physics* 216b22–30

There are some who think that rarity and density make it clear that there is a void. For if there is no rarity and density it is not possible for things to contract and condense. And if that did not occur, either there could be no motion at all, or the universe will swell out, as Xuthus[70] said, or air and water must always be exchanged in equal quantities, e.g., if a cupful of water turns into air, simultaneously an equal quantity of air must have turned into water; or else there is necessarily a void, for otherwise contraction and expansion are not possible.

53. ARISTOTLE *De Caelo* 300b8–301a11

Therefore both Leucippus and Democritus, who say that the primary bodies are in eternal motion in the void and the infinite, must say what motion it is, i.e., what their natural motion is. For if each of the elements is moved violently by another, each one must also have a natural motion, with which the violent motion is contrasted; and that which imparts the primary motion must do so not violently, but naturally. For it goes on to infinity if there is no first natural mover, but everything is moved by something else which was itself subject to violent motion. The conclusion is the same as that which follows from what is said in the *Timaeus*,[71] that before the world came into being the elements were in disorderly motion. For the

69 Presumably, as in the case of the wineskins and the wine, the water and ash were supposed to interpenetrate, each filling the void gaps in the other. Clearly that supposition presupposes what the alleged phenomenon purports to establish.

70 A Pythagorean, according to Simplicius (683.24).

71 52–3.

motion in question must be either violent or natural, and if they were in natural motion, it is necessary that there was a world, if one wants to have a reasonable theory. ...[72]

Those who postulate infinitely many things moving in the infinite must admit that, if what moves them is one thing, necessarily they will have one motion, so that they will not move in disorder, but if the movers are infinitely many, necessarily the motions will be infinitely many. For if they are finite, there will be order; for disorder does not result from things not moving to the same place, for as things are now they do not all move to the same place, but only those of the same kind. Further, to be in disorder is no different from being contrary to nature; for order is simply the nature appropriate to each kind of sensible thing. Now it is absurd and impossible that what is infinite should have a disorderly motion; for the nature of things is simply what most things have most of the time; but on this view, on the contrary, it results that disorder is natural and order and the world contrary to nature.[73] Yet nothing natural occurs by chance.

[Cf. SIMPLICIUS Commentary on the above 583.20–2; ARISTOTLE *Metaphysics* 1071b32–1072a7; THEODORETUS *Cure for the Ills of the Greeks* II.11.]

54. a. ARISTOTLE *De Caelo* 303a3–b8

Some other theories too, such as that of Leucippus and Democritus of Abdera, produce unreasonable consequences. They say that the primary bodies are infinite in number and indivisible in size, and many cannot come to be from one nor one from many, but everything is generated by their combination and interlocking. In a way they too make everything into numbers or composed of numbers; even if they do not say so clearly, all the same that is what they mean. Moreover, if the bodies differ in shape, and the shapes are infinite in number, they say that the simple bodies are

72 Aristotle's criticism relies on the distinction, basic to his own cosmology, between the natural motion of the elements, i.e., motions intrinsic to their individual natures, and 'violent motion,' i.e., motion caused by external force. A stone's falling to the ground when released is an example of the former, and a stone's being thrown upwards an example of the latter. The atomists rejected this distinction as applied to the motion of the atoms. See commentary 'Weight,' p. 180.

73 In terms of Aristotle's own theory, disorder is by definition a condition which obtains only exceptionally. Hence the atomistic theory of precosmic disorderly motion of the atoms is contradictory. It is clear, however, that the atomists' conception of the precosmic motion as disorderly is not a statistical one. For them the precosmic motion is disorderly either in the sense that it is objectively not subject to causal law or in the sense that, since we are unable to discover the laws governing it, we have to consider it as if it were objectively lawless. See commentary 'Cause and Necessity,' pp. 191–2.

infinite in number too. They do not make clear what the shape is of each of the elements, except that they ascribe the sphere to fire; they differentiate air and water and the rest by differences of size, taking it that the nature of these is as it were a generative mixture of all the elements.

First of all, they commit the same error [sc. as Anaxagoras, discussed at 302b10–303a3] in not making their principles finite in number, though it is possible on that assumption to say everything else that they hold. Then if the differences of the primary bodies are not infinite, it is clear that the elements will not be infinite. Further, in positing atomic bodies they necessarily conflict with the mathematical sciences and reject many ordinary beliefs which accord with perception, as we have said in our treatment of time and motion.[74] And at the same time they necessarily contradict themselves; for it is impossible that if the elements are atomic air and earth and water should differ in size. For the largest bodies will always be separated out and so they will give out, but that is the way that they say water and air and earth come to be from one another. Further, not even on their own hypothesis does it seem that the elements would be infinite, if the bodies differ in shape, and all shapes are composed of pyramids, straight-edged shapes from straight-edged pyramids, and the sphere from eight parts.[75] For there must be some principles of the shapes; so whether there is one or two or more, the number of simple bodies will be the same. Further, if each of the elements has its own motion, and the motion of a simple body is simple, and the simple motions are not infinite because the simple paths are not more than two nor are the places infinite, by this argument too the elements would not be infinite.

b. SIMPLICIUS Commentary on the above 609.19–25; 610.22–8

They [Leucippus and Democritus] said that these [the atoms] were the only continuous objects; for the other things which appear to be continuous are in fact things in contact with one another. So they abolished division, saying that apparent division is actually separation of contiguous things, and for that reason they said that many cannot come to be from one, for the atom cannot be divided, nor can one truly continuous thing come to be from many, but each thing seems to come to be as a single thing because of the interlocking of atoms. The Abderites called the interlocking 'alternation'[76] as Democritus does.

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74 *Physics* VI.1–2. See commentary 'Divisibility,' pp. 169–70.

75 See commentary 'Divisibility,' p. 168.

76 'Alternation' renders *epallaxis*, apparently an atomistic technical term, used by Aristotle in **54a.** The variant forms *peripalaxis* and *peripalxis*, found in some mss., would appear to mean respectively 'being scattered about' and 'vibration.' See McDiarmid 34.

[610.22–8] They do not, however, say what the shape is of air or water or earth or their elements; the only difference they cite is one of size between their elements, saying that air is composed of the smaller atoms of the same shapes, water of the larger, and earth of the larger still. They no longer differentiate them by shape, but say that each of them is composed of atoms of all shapes, the same in each case.

c. PHILOPONUS Commentary on *Physics* 494.19–25

It is not merely on our theory that being limited is distinct from being in contact. The same result follows from the hypotheses of Democritus; for as the atoms are carried about in the void they are limited, but they are not in contact with anything.[77]

d. PHILOPONUS Commentary on *GC* 158.26–159.3

In describing the atoms as being in contact with one another Democritus did not use the term 'contact' in the strict sense; he applied the term to the atoms' being close to one another, not widely separated, for they are totally separated by the void.

e. PHILOPONUS Commentary on *GC* 160.7–11

The followers of Leucippus maintained that the atoms touch one another and are separated by the void, through which they affect and are affected, except that the followers of Leucippus did not use the term 'touch' in the strict sense, as was said above [cf. **54d**].

55. a. ARISTOTLE *De Caelo* 305a33–b26

We must now return to consideration of how the elements come to be from one another. ... The followers of Empedocles and Democritus seem unaware that on their view they do not really come to be from one another, but only seem to do so. For they say that each element is already there and is separated out, as if things came to be from a container instead of from matter, and nothing changed when something came to be. Then, even if that were so, the results would be no less absurd. For the same quantity does not seem to become heavier when it is condensed. But those who say that water is already in air and is separated out have to say that; for when water comes to be from air, it is heavier. Further, there is no necessity for one of two bodies mixed up together always to take up more space when it is separated out; but when air comes to be from water, it occupies more space; for the finer-textured body takes up more space. This is apparent from the transition; for sometimes when a liquid is turned to vapour and steam the vessel containing the volume is broken because the space is too

77 On **54c–e** see commentary 'The Void,' pp. 186–8.

confined. So if there is no void at all nor do bodies expand, as the proponents of this theory maintain, the impossibility is manifest; but if there is a void and expansion, it is absurd that what is separated should always occupy more space. And it is necessary that the process of coming to be from one another should come to a stop, if an infinite number of finite quantities are not contained in a finite quantity. For when water comes to be from earth, a certain amount of the earth is removed, if coming to be occurs by separation; and similarly when something comes to be from the residue. Now if that goes on for ever, the result is that infinite quantities exist in the finite quantity; and since that is impossible, they could not come to be from one another for ever.[78]

b. ARISTOTLE *De Caelo* 306a26–307b5

Further, they have to say that not every body is divisible, but rather to conflict with the most exact sciences. For these, i.e., the mathematical sciences, assume that even the intelligible is divisible, but they, wishing to preserve their assumptions, do not admit that even the perceptible is divisible. For those who assign a shape to each of the elements and distinguish their natures in that way have to make them indivisible, for if the pyramid or the sphere is divided what is left will not be a sphere or pyramid. So either the part of fire is not fire, but there is something prior to the element, since everything is either an element or composed of elements, or else not every body is divisible. ...

Moreover, though it was primarily with reference to the properties and powers and motions of bodies that they assigned them their shapes, the latter are inappropriate. For instance, since fire is mobile, and since it heats and burns, some made it a sphere, others a pyramid. They are the most mobile since they are in contact with the fewest things and have the smallest base, and most productive of heat and burning because the one [the

78 Aristotle here returns to the objection to atomism raised in **54a**, viz. that on the atomists' theory the elements, earth, air, fire, and water, are not genuinely transformed into one another, as in Aristotle's own theory, but separated out from a pre-existing mixture. The atomists reject Aristotle's premiss that the elements are stuffs of irreducibly different kinds: on their view the elements, i.e., the basic substances, are the atoms, which are uniform in kind, and earth, air, etc. are differently structured aggregates of atoms. Their account of what it is, e.g., for water to turn into air (in evaporation) is that one comparatively stable structure is transformed into another, less stable one, perhaps by the breaking up of some of the bonds linking the atoms in the former (no details of any atomistic accounts of such processes survive). None of Aristotle's arguments show that this type of account of elemental transformation is objectionable in principle, though he points to questions which that kind of theory has to answer, e.g., why does a liquid expand when it turns into steam?

sphere] is an angle all over, while the other has the sharpest angles, and heat and burning are produced by the angles, so they say. Now as far as motion is concerned, both are wrong; even if these are the most mobile of shapes, they are not mobile with the motion appropriate to fire. For the motion of fire is straight up, whereas these move in a circle, which is called rolling. Then if earth is a cube because it is firmly based and stable, yet is not stable everywhere but only in its own place, and moves from the place which belongs to another element if not prevented, as do fire and the rest, it is clear that fire and each of the elements will be a sphere or a pyramid when it is in the place belonging to another element, and a cube when in its own place. Moreover, if fire heats and burns because of its angles, all the elements will be productive of heat, though perhaps one more than another; for they all have angles, e.g., the octahedron and the dodecahedron. According to Democritus even the sphere, being a sort of angle, cuts, since it is mobile. So they will do so in different degrees. But it is obvious that this is false. A like consequence will be that mathematical bodies also cut and burn. For they too have angles, and they contain indivisible spheres and pyramids, especially if there are indivisible magnitudes, as they say. And if some do and some do not, they should say what the difference is, and not just say so as they do. Next, if what is burned is set on fire, and fire is a sphere or a pyramid, what is burned has to become spheres or pyramids. Let it be granted that cutting and dividing is a reasonable consequence of shape; however, that the pyramid should necessarily make pyramids or the sphere spheres is altogether unreasonable, like stipulating that a knife cuts things up into knives or a saw into saws. Next, it is absurd to assign fire its shape solely with reference to division, as it seems rather to compact and condense than to separate. It separates things of an unlike nature and condenses things of like, and the condensation is essential (for compacting and unifying is characteristic of fire) while the separation is accidental (for in condensing the like it expels the unlike). So it ought to have been assigned either with reference to both or rather with reference to condensation.
[Cf. SIMPLICIUS Commentary on *Physics* 36.1–7.]

56. ARISTOTLE *De Caelo* 309a1–18

Those who assert that the primary elements are bodies are better able [sc. than those who assert that they are planes, i.e., Plato] to maintain that the larger are heavier. But since that does not appear to be true of compound bodies, but we see that many which are smaller are heavier, e.g., bronze is heavier than wool, some think and say that the cause is different. They say that the void contained in the compound lightens the bodies and sometimes makes the larger lighter, since they have more void. And this is the reason

why one compound is often bigger than another though composed of an equal number of solids or even fewer; in general the cause of anything's being lighter than something else is the presence of more void. That is what they say, but those who distinguish [sc. heavy and light] in this way must add that the lighter thing contains not merely more void, but also less solid; for if it exceeds that proportion, it will not be lighter. That is why they say that fire is the lightest thing of all, since it contains the most void. So it will follow that a large quantity of gold will be lighter than a small amount of fire, since it contains more void, unless it also has many times more solid. So that is what they must say. ...

57. SIMPLICIUS Commentary on *De Caelo* 242.15–26

Nor is it possible that the elementary bodies should be distinct but infinite in number, as Leucippus, Democritus, and their followers posited before him [i.e., Aristotle], and Epicurus later. They said that the principles were infinite in number, and they thought that they were atomic and indivisible and incapable of being affected because they were solid and lacking in void; for they said that division occurs in bodies by means of the void. These atoms were separated from one another in the infinite void, differing in shape, size, arrangement, and order, and they travelled about in the void overtaking one another and colliding, and some rebounded at random, but others became entangled with one another through the fitting together of their shapes, sizes, arrangements and orders, and thus they brought compounds into being.

58. a. STOBAEUS I.10.14 [= AETIUS I.3.15–16]

Leucippus of Miletus says that the principles and elements are the plenum and the void.

Democritus says that they are the solid and empty things.

b. Ps-PLUTARCH *Epitome* I.18.3 [= AETIUS I.18.3]

Leucippus, Democritus ... and Epicurus say that the atoms are infinite in number and the void infinite in size.

[Cf. CICERO *Academica* II.37.118, II.38.121; CICERO *De Natura Deorum* I.24.66; CLEMENT *Protrepticus* 66.1–2; HERMIAS *Mockery of the Pagan Philosophers* 12–13; PLUTARCH *On Isis and Osiris* 45, 369a; Ps-GALEN *History of Philosophy* 7, 18; SEXTUS *Against the Mathematicians* X.318; THEODORETUS *Cure for the Ills of the Greeks* IV.9, 14; VARRO *De Lingua Latina* VI.39.]

59. a. ARISTOTLE *Physics* 265b23–9

The same view [i.e., that locomotion is prior to other kinds of change] is held by those who say that ... things move by means of the void. For they

say that nature moves by way of locomotion (for movement by means of the void is motion in space), and none of the other sorts of change applies to the primary things, but to the things which are composed of them; for they grow, decay, and alter through the joining together and separation of the atomic bodies.

b. SIMPLICIUS Commentary on the above 1318.33–1319.5

That is to say, the natural, primary, atomic bodies; for those are what they called 'nature,' and said that they were moved by their weight through the void, which yielded and offered no resistance, and so they moved in space. For they said that they 'are scattered about.'[79] This is not merely the primary, but the only kind of change which they ascribe to the elements. The other kinds they ascribe to the things formed from the elements; for they say that they grow and decay and alter and come to be and pass away through the joining and separation of the primary bodies.

60. a. Ps-PLUTARCH *Epitome* I.3.18 [= AETIUS I.3.18]

Democritus said that there were two [sc. primary properties of atoms], size and shape, but Epicurus added a third, weight; for it is necessary, he said, for the bodies to be moved by the blow of weight.

b. STOBAEUS I.14.1f [= AETIUS I.12.6]

Democritus said that the primary bodies (those were the solids) had no weight, but were moved by mutual impact in the void. And he said that it was possible for an atom to be as big as a world.

c. Ps-PLUTARCH *Epitome* I.23.3 [= AETIUS I.23.3]

Democritus said that one kind of motion was vibration.

d. SIMPLICIUS Commentary on *Physics* 42.10

Democritus said that the atoms are by nature immobile and are moved by a blow.

e. CICERO *De Fato* 20.46

The atom swerves, he [i.e., Epicurus] says. Why, first of all? For they had another principle of motion, impact, according to Democritus (which he calls a blow), and according to you, Epicurus, weight.

[Cf. EUSEBIUS *Praeparatio Evangelica* XIV.14.5.]

61. a. ARISTOTLE *De Caelo* 277b1–5

Nor is their motion up or down caused by some other body, nor violent, as some say when they attribute it to being squeezed out. For a larger amount of fire would travel more slowly upwards and a larger amount of earth more

79 Reading with DK *peripalassesthai* for the mss. *peripalaisesthai*. McDiarmid's suggestion *periplekesthai* 'interlock' (McDiarmid 34) does not give the required sense. See notes on **54b** and on **113** (66).

slowly downwards, but in fact the opposite occurs, as larger amounts of fire and of earth travel more quickly to their appropriate place.

b. SIMPLICIUS Commentary on *De Caelo* 569.5–9

The followers of Democritus and later Epicurus say that all atoms are of the same nature and have weight, but because some are heavier they sink down and in so doing push the lighter ones up, thus, they say, making it appear that some are light and some heavy.

[Cf. 269.4–14, 712.27–31.]

c. THEMISTIUS Commentary on *De Caelo* 215.6–8

They [i.e., Leucippus and Democritus] must say that bodies are in themselves heavier, but appear lighter through containing void, and similarly Epicurus makes the atom heavy, but indivisible.

62. CICERO *De Finibus* I.6.17

He [i.e., Democritus] thinks that what he calls atoms, that is bodies indivisible because of their solidity, travel about in an infinite void, in which there is neither top nor bottom nor middle nor end nor limit, in such a way that they collide and stick together, from which results everything that there is and that is perceived. That motion of atoms must be understood as having had no beginning, but as having gone on from eternity.

63. a. EUSEBIUS *Praeparatio Evangelica* XIV.23.2–3 [quoting DIONYSIUS, third-century Bishop of Alexandria]

Those who give the name 'atoms' to an infinite number of tiny, indestructible bodies, and postulate empty space unbounded in extent, say that these atoms travel at random in the void. In their disorderly rush they collide by chance, get entangled through their variety of shapes and latch on to one another, thus making the world and the things in it, or rather infinitely many worlds. Epicurus and Democritus were of this opinion; but they differed to this extent, that the former held that the atoms were all extremely small and hence imperceptible, while Democritus held that some atoms were extremely large. Both say that there are atoms, and that they are so called because of their indestructible solidity.

b. PHILOPONUS Commentary on *Physics* 398.16–17

For not only do they [the atoms] have different shapes, but some are larger and others smaller.

64. a. ARISTOTLE *Physics* 251b14–17

On the subject of time, everyone with one exception [i.e., Plato] seems to agree that it did not come into being. This is the argument that Democritus uses to prove that it is impossible for everything to have come into being; for time did not come into being.

b. SIMPLICIUS Commentary on *Physics* 1153.22–4

Democritus was so convinced that time was eternal that he used the premiss that time did not come into being as something obvious in order to demonstrate that not everything came into being.

65. SEXTUS *Against the Mathematicians* X.181

There seems to be ascribed to the scientists of the school of Epicurus and Democritus some such conception of time as this: 'Time is an appearance in the form of night and day.'

66. SIMPLICIUS Commentary on *Physics* 701.30–4

If there are many heavens, i.e., worlds, as Democritus and his followers posit, then the rotation of each of them would be time, and so there would be many simultaneous times, which is impossible. For it is possible that there should be simultaneous motions, but not simultaneous times.

67. a. SIMPLICIUS Commentary on *Physics* 571.24–9

Place must be either the form of what is in the place, or its matter, or the interval between the boundaries of its surroundings (as some of the ancients, e.g., Democritus, and some of the moderns, e.g., Epicurus ... held) or the boundaries of the surroundings ... Democritus, Epicurus and their followers say that this interval is void, so that it is sometimes filled by body and sometimes left void.

[Cf. 601.22; 618.18–20.]

b. SIMPLICIUS Commentary on *Physics* 533.14–19

Therefore Eudemus in the third book of his *Physics*, following what is said here and removing each of the causes from place, as something agreed, says 'Is it then the cause of change? But that is impossible, Democritus; for it needs to have a certain power of initiating change.' For Democritus said that place was the void, which, as something void in its own nature, is for that reason powerless and inert.[80]

[Cf. 534.1–3.]

68. ARISTOTLE *De Caelo* 308a17–19

It is absurd to think that there is neither up nor down in the cosmos, as some say. For they say that there is neither up nor down, since the cosmos is everywhere alike.

[Cf. SIMPLICIUS Commentary on the above 699.3–6.]

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80 See commentary 'Chance and Necessity,' p. 194, n. 26.

PRINCIPLES OF CAUSATION

69. a. ARISTOTLE *Physics* 252a32–b2

In general, it is not correct to count it a sufficient principle [sc. of explanation] that something always is, or always comes to be a certain way; Democritus reduces natural causes to that principle, viz. that that is how things were previously. He does not think that one should ask for a principle of what is always so; that is right in some cases, but not in all.

b. ARISTOTLE *De Generatione Animalium* (*GA*) 742b18–34

Those who, like Democritus of Abdera, say that it always happens that way, and consider that that is a principle in those cases, do not even given an adequate account of the necessity of the cause. He reasons that there is no principle [= beginning] of what is so always and of what is infinite, and the cause is a principle, and what is so always is infinite, so asking for the cause in any such case is looking for a principle of the infinite. But according to this argument, according to which they require that you should not look for the cause, there will be no demonstration of any of the eternal things; but it seems that there is in many cases, both in cases of things which come to be always, and in cases of things which are so always. For it is eternally the case that the triangle has angles equal to two right angles, and that the diagonal is incommensurable with the side, but all the same there is a cause and a demonstration of them. It is correct to say that one should not demand that one look for a principle of everything, but not to say this of every case of what is or comes to be always, but only of those eternal things which happen to be principles; for the knowledge of the principles is not demonstration but another sort.

70. ARISTOTLE *GC* 323b10–15

Democritus alone took a different view from the rest; he says that what affects and what is affected are the same and alike, for different and dissimilar things cannot be affected by one another. But even if different things do affect one another, this occurs not in virtue of their difference, but in virtue of the same property's applying to both.[81]

71. a. ARISTOTLE *Physics* 195b36–196b5

Some even question whether it [i.e., chance] exists or not. For they say that nothing comes about by chance, but for all of the things that we say come about fortuitously or by chance there is some determinate cause,

81 See **113** (49), with footnote.

e.g., the cause of one's coming by chance into the market-place and meeting someone there whom one wanted to meet but did not think one was going to, is one's having come to buy something. ... But this too is an astonishing view. For many things come about and are so by chance and fortuitously, and people are not unaware that it is possible to refer everything that comes about to some cause, which is what the ancient theory that denies chance says, but yet everyone says that some things are so by chance and others not by chance. ...

Some hold that this heaven and all the worlds are caused fortuitously, since the swirl and the motion that separates everything out and puts it in order comes about fortuitously. But that is quite astonishing. For they say that animals and plants neither are nor come to be by chance, but either nature or mind or something else of that sort is the cause of them (for from each kind of seed there does not come a chance product, but from this kind an olive-tree and from that a man), but the heavens and the most divine of perceptible things come about fortuitously, while there is no such cause of animals and plants. ... In addition to other absurdities in this view, it is yet more absurd for someone to say this who sees that in the heavens nothing comes about fortuitously, while in the things that are not so by chance, many things happen by chance; the opposite was to be expected.

[Cf. ARISTOTLE *Parts of Animals* 641b20–4.]

b. SIMPLICIUS Commentary on *Physics* 196a14–15; 330.14–20

The words 'the ancient theory that denies chance' seem to refer to Democritus; for although he appears to have made use of chance in his theory of the formation of worlds, in his more detailed discussions he says that chance is not the cause of anything, but refers everything to other causes, e.g., the cause of finding the treasure is digging or planting the olive, or of the bald man's fracturing his skull is the eagle's having dropped the tortoise to break its shell.[82]

c. SIMPLICIUS Commentary on *Physics* 327.24–26

When Democritus says 'A swirl of forms of all kinds was separated off from the totality' [= **D7**] (how and from what cause he does not say) he seems to bring it into being fortuitously and by chance.

d. THEMISTIUS Commentary on *Physics* 49.13–16

They [Democritus and others] assign the greatest effects to it [chance] but have handed down to men not the slightest account of it, though they assign the innumerable worlds and the swirl and the all-embracing order to no other cause, but merely mention chance and randomness.

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82 The traditional account of the death of the tragedian Aeschylus.

[Cf. PHILOPONUS Commentary on *Physics* 261.31–263.2.]

72. THEODORETUS *Cure for the Ills of the Greeks* VI.15

Anaxagoras, Democritus, and the Stoics say that it (i.e., chance) is a cause which is unclear to human reason.

73. LACTANTIUS *Institutiones Divinae* I.2.1–2

To begin with that question which seems essentially basic, whether there is a providence which looks after everything or whether everything happens or comes about fortuitously. The latter opinion was introduced by Democritus and upheld by Epicurus.

[Cf. III.17.21–7; AETIUS II.3.2; DIDYMUS THE BLIND Commentary on Ecclesiastes 7.13 (= *CPF* I* 51.9T); NEMESIUS *On the Nature of Man* 44.]

74. **a.** ARISTOTLE *GA* 789b2–3

Democritus neglects the final cause, reducing all the operations of nature to necessity.

b. CICERO *De Fato* 10.23

Democritus, the proponent of the theory of atoms, preferred to accept that everything happens of necessity, rather than to deprive the indivisible corpuscles of their natural movements, as Epicurus did.

c. CICERO *De Fato* 17.39

... that everything happens by fate, in such a way that fate has the force of necessity. That was the opinion of Democritus ...

d. STOBAEUS I.4.7c [= AETIUS I.25.3–4]

Parmenides and Democritus say that everything happens by necessity, which is the same as fate, justice, providence, and the creator.

Leucippus says that everything happens by necessity, which is the same as fate; for he says in his *On Mind* 'Nothing happens in vain, but everything from reason and by necessity' [= **L1**].

e. Ps-PLUTARCH I.26.2 [= AETIUS I.26.2]

Democritus says that it [i.e., necessity] is impact and motion and a blow of matter.

f. SEXTUS *Against the Mathematicians* IX.113

So that the world would not be moved of necessity and by the swirl, as Democritus and his followers said.

g. EUSEBIUS *Praeparatio Evangelica* VI.7.2 [citing OINOMAUS, second century AD Cynic philosopher]

Democritus, if I am not mistaken, has it in mind to show that the noblest of human things [i.e., free will] is a slave.

[Also cited by THEODORETUS *Cure for the Ills of the Greeks* VI.8.]

75. Ps-PLUTARCH *Miscellanies* 7

Democritus of Abdera maintained that the universe is infinite because it was not created by anything. Further, he says that it is changeless and sets out an explicit, comprehensive account of the nature of the whole. The causes of the things that now come about have no beginning, but absolutely everything that has come about and is coming about and will come about is totally governed in advance by necessity from eternity. He says that the sun and moon have come into being. They travel about separately, and their nature is not completely hot or totally bright, but on the contrary they are similar in nature to the earth; for each formerly came into being in a separate foundation of a world, and afterwards as the orbit of the sun grew larger fire became caught up in it.

76. PLUTARCH *On the Principle of Cold* 8, 948c

To the scientist who seeks truth for the sake of understanding, the discovery of immediate causes is not the end but the beginning of the journey to the primary and the highest. That is why Plato and Democritus were right, in seeking the causes of heat and of weight, not to stop their enquiry at earth and fire but to refer the sensible phenomena to intelligible principles, until they reached, as it were, the smallest seeds.

COSMOLOGY

77. a. DIOGENES LAERTIUS IX.30–3

He [i.e., Leucippus] believed that the totality of things is infinite and that they change into each other, and that the universe consists of void and the plenum. Worlds come into being when bodies fall into the void and become entangled with one another; and from their motion as they grow the nature of the stars comes into being. The sun travels round the moon in a larger circle; the earth floats in the middle, swirling round, shaped like a drum. He was the first to put forward the atoms as principles. So much in summary; in detail it is as follows.

(31) He says that the universe is infinite, as has been said. Part of it is a plenum, and part void, which he says are the elements. There are infinitely many worlds composed of this, and they are resolved into those elements. The worlds come into being in this way. A large number of bodies of every shape become separated from the infinite into a great void, congregate together and form a single swirl, in which, as they collide and circle in all sorts of ways, they are separated out, like to like. Because of their number they can no longer rotate in equilibrium,

but the small ones are as it were sifted out into the external void; the rest remain and, becoming entangled with one another, move round together, making up a primary spherical structure. (32) There separates off from this[83] a sort of membrane, containing bodies of every kind; as these swirl round the surrounding membrane becomes thin through the resistance of the central mass, as the bodies on its inner surface are continually flowing off into the centre because of the contact within the swirl. In this way the earth comes into being, as the bodies which have been carried into the middle remain there; and on the other hand the surrounding membrane grows by separating off bodies from the outside, adding to itself any which it touches as it whirls round. Some of these fasten together into a structure which is at first moist and muddy, but which dries as it rotates in the universal swirl, finally catching fire and constituting the nature of the stars. (33) The circle of the sun is outermost, that of the moon the nearest and the others in between. All the heavenly bodies are set alight by the speed of their motion, but the sun is kindled from the stars as well. The moon contains a small quantity of fire. The sun and moon are eclipsed < ... and the obliquity of the zodiac is caused>[84] by the earth's sloping towards the south. In the north it is always snowy, cold, and frozen. The sun is eclipsed rarely, the moon frequently, because their cycles are unequal. Just like the coming into being of worlds, so do their growth, decay, and destruction occur according to a certain necessity, the nature of which he does not explain.

b. STOBAEUS I.22.1e [=AETIUS II.7.2]

Leucippus and Democritus stretch round the world a coat or membrane made of hook-shaped atoms.

78. HIPPOLYTUS *Refutation of All Heresies* I.12–13

Leucippus, an associate of Zeno, did not adhere to the same doctrine, but says things are infinitely many and always in motion, and that coming to be and change are continuous. He says that the elements are the plenum and the void. He says that worlds come into being in this way; when many bodies are collected out of the surroundings and flow together into a great void, in their collisions those of the same and similar shapes get entangled, and from these entanglements stars come into being and grow and decay through necessity. But what the necessity might be he does not explain.

Democritus was known to Leucippus. Democritus of Abdera, son of Damasippus, associated with many naked sages in India and priests and astrologers in Egypt and magi in Babylon. Like Leucippus he says that the

83 I follow Kerschensteiner 54 in reading *toutou* instead of the mss.' *touto*.

84 Supplementation in DK.

elements are plenum and void, calling the plenum what is and the void what is not. He said that the things that there are are always in motion in the void, and that there are infinitely many worlds differing in size, some with neither sun nor moon, some with sun and moon larger than ours and some with more. The distances between the worlds are unequal, and there are more in some parts of the universe and fewer in others; some are growing, some are at their peak, and some decaying, in some parts they are coming into being and in others ceasing to be. They are destroyed by collision with one another. There are worlds without animals or plants or any moisture. In our world the earth came into being before the stars, and the moon is the lowest, then the sun, then the fixed stars. Nor are the planets at equal heights either. A world is at its peak until it can no longer assimilate material from outside. He used to laugh at everything, holding all human affairs to be laughable.

79. a. Ps-PLUTARCH *Epitome* I.4 [= AETIUS I.4]

The present world was formed in an curved shape in the following way. The atomic bodies were in continuous, chance, undesigned motion of extreme rapidity, and many, of a variety of shapes and sizes (because of their number), collected together in the same place. Once collected, all the larger and heavier began to sink down, and the small, round, smooth, slippery ones began to be squeezed out by the pressure of the atoms and to travel upwards. And when the force which was driving them upwards began to be exhausted, but they were prevented from travelling downwards, they were pushed into places where there was room for them. These were at the circumference, and in these the mass of bodies became curved; and by tangling together in that curved shape they formed the heavens. The atoms were varied but of the same nature, as has been said, and those which were pushed upwards fashioned the nature of the stars. And the great number of bodies which was exhaled up struck the air and squeezed it, setting it in motion and turning it into wind, which caught up the stars and carried them round, thus preserving their present celestial motion. Then from the atoms which sank down the earth came into being, and from those which rose up came the heavens, fire and air. There was a large amount of material contained in the earth, and when that was compressed by the blows of the wind and the exhalations from the stars, the whole structure, composed of tiny parts, was squeezed together, giving rise to moisture, which, being liquid, flowed into the hollow places which could hold and contain it, or else the water flowed down and hollowed out the low-lying places. That is the way in which the principal components of the world came into being.

b. STOBAEUS I.20.1d [= AETIUS I.24.2]

Empedocles, Anaxagoras, Democritus, Epicurus, and all those who form worlds by accumulation of tiny corpuscles introduce aggregation and separation, but not, strictly speaking, coming to be and ceasing to be, for these come about not by change of quality, but quantitatively, by accumulation.

80. a. ARISTOTLE *Physics* 250b18–21

Those who say that there are innumerable worlds, some coming to be and some ceasing to be, say that change is always occurring (for necessarily their coming and ceasing to be is accompanied by change).

b. SIMPLICIUS Commentary on the above 1121.5–9

Some suppose that there are infinitely many worlds, e.g., Anaximander, Leucippus, Democritus, and their followers, and later the school of Epicurus; they supposed that they came into existence and went out of existence to infinity, some always coming into existence and others ceasing to exist, and they said that change was eternal, for without change there is no coming into existence or ceasing to exist.

c. ARISTOTLE *Physics* 203b24–7

Since thought does not give out, number seems infinite and mathematical magnitudes and what lies beyond the heavens. And since what lies beyond is infinite, it seems that there are infinite body and infinitely many worlds. For why should they be here rather than there in the void?[85]

d. PHILOPONUS Commentary on the above 405.23–7

This is why Democritus supposed that there are infinitely many worlds, since he supposed the void to be infinite. For what selection would cause this part of the void to be filled up with a world, but others not? So if there is a world in any part of the void, there will be one in all the void.[86] And since the void is infinite, the worlds too will be infinitely many.

[Cf. AETIUS II.1.3; ALEXANDER Commentary on *Metaphysics* 534.8–9; AMBROSE *Hexaemeron* I.1.2; AUGUSTINE *Academica* III.10.23; CICERO *Academica* II.17.55, II.40.125; Ps-GALEN *History of Philosophy* 44; LACTANTIUS *On the Wrath of God* 10.10; SIMPLICIUS Commentary on *Physics* 467.16–19, Commentary on *De Caelo* 202.16–17.]

81. STOBAEUS I.15.6b [= AETIUS II.2.2]

Leucippus and Democritus say that the world is spherical.

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85 See Luria 93 and commentary 'Atoms: Theoretical Role,' p. 162.

86 I.e., in every part of the void.

82. **a.** STOBAEUS I.20.1f [= AETIUS II.4.6, 9]

Leucippus [and others] say that the world is perishable.

Democritus says that the world perishes when the larger conquers the smaller.

b. SIMPLICIUS Commentary on *De Caelo* 310.8–17

This [i.e., the view that a world, on ceasing to exist, turns into another world] was the view of Leucippus, Democritus, and their followers. ... And Democritus' worlds, which change into other worlds composed of the same atoms, are one in type, if not numerically one.

ASTRONOMY AND METEOROLOGY

83. **a.** STOBAEUS I.24.1e [= AETIUS II.13.4]

[On the nature of the heavenly bodies] Democritus says they are stones.

b. ACHILLES *Introduction to Aratus* I.13

Neither Anaxagoras nor Democritus in the *Great World-System* accepts that the stars are alive.

84. Ps-PLUTARCH *Epitome* II.15.3 [= AETIUS II.15.3]

Democritus says that the fixed stars are first [i.e., furthest from the earth] and after them the planets, after which come the sun, Venus, and the moon.

85. Ps-PLUTARCH *Epitome* II.16.1 [= AETIUS II.16.1]

Anaxagoras, Democritus, and Cleanthes say that all the heavenly bodies travel from east to west.

86. **a.** STOBAEUS I.25.3h [= AETIUS II.20.7 and 23.7] [Separated by Diels *Dox.*]

[On the nature of the sun] Democritus says that it is a white-hot lump or stone. And the solstices come about because of the swirling which carries it round.

b. CICERO *De Finibus* I.6.20

The sun seems large to Democritus, who was an educated man, expert in geometry; he [i.e., Epicurus] thinks that is perhaps a foot across, for he thinks that it is as big as it appears, or just a little larger or smaller.

87. LUCRETIUS V.621–36

First of all, it seems that this [i.e., the apparent motions of sun and moon] can come about as the holy opinion of the man Democritus lays down. The nearer each of the heavenly bodies is to the earth, the less can it be borne

along by the swirl of heaven, for its fierce, rapid strength diminishes lower down, and therefore the sun is gradually left behind with the hindmost constellations, because it is much lower than the bright constellations. More so in the case of the moon; the lower its course, nearer the earth and further from heaven, the less able is it to keep up with the constellations. And the weaker the swirl by which, being lower than the sun, it is borne along, the more quickly do all the constellations catch it up and pass it. That is why it appears to come back to each constellation more rapidly, because the constellations are returning to it.

88. PLUTARCH *On the Face in the Moon* 16, 929c

But, says Democritus, it [i.e., the moon] is situated in a straight line with the sun and so catches and receives its light; so it was to be expected that it should be visible by letting it shine through.

89. STOBAEUS I.26.1c [= AETIUS II.25.9]

Anaxagoras and Democritus say that it [i.e., the moon] is a white-hot solid containing plains and mountains and chasms.

90. STOBAEUS I.26.4 [= AETIUS II.30.3]

[The explanation of the moon's earth-like appearance] Democritus says it is the shadow of its high parts; for it has hollows and valleys.

91. ARISTOTLE *Meteorology* 345a25–30

Anaxagoras, Democritus, and their followers say that the Milky Way is the light of certain stars. For when the sun travels underneath the earth it does not shine on some of the stars. The light of those on which it does shine is not seen, because it is obscured by the rays of the sun; but they say that the light of those which are blocked off from the sun by the earth is the Milky Way.

[Cf. ALEXANDER Commentary on the above 37.23–8; AETIUS III.1.6.]

92. ARISTOTLE *Meteorology* 342b25–9, 343a25–8

Anaxagoras and Democritus say that comets are a conjunction of the planets, when they come so close together that they seem to touch one another. ... Democritus ... affirms that stars have been seen when comets dissolve; but that ought to happen not just sometimes, and sometimes not, but always.

[Cf. ALEXANDER Commentary on the above 26.11–17; PHILOPONUS on the same passage 75.21–76.2; AETIUS III.2.2; SCHOLIAST on ARATUS 545.20; SENECA *Natural Questions* VII.3.2.]

93. a. VITRUVIUS IX.5.4

I have expressed the figures of the constellations as they are shaped and formed in the heavens, according to the teachings of the scientist Democritus.

b. VITRUVIUS IX.6.3

Thales [and others] and Democritus of Abdera handed on their discoveries of the laws according to which natural events are ordered and have their effects. Relying on their discoveries Eudoxus ... Aratus and others devised the method of calendars to show the rising and setting of the stars and the significance of the seasons and handed it on to their successors.

[Astronomical data attributed to Democritus are preserved in various calendars of the fourth century BC and later centuries. For details see Freeman 1948 (see bibliography, item 1), pp. 94–6.]

94. STOBAEUS I.29.1 [= AETIUS III.3.10–11]

Leucippus states the view that thunder is produced by a violent discharge of fire trapped in the thickest clouds.

Democritus says that thunder occurs as a result of an irregular compound's forcing its way down through the cloud which contains it. Lightning is a collision of clouds, as a result of which the elements of fire are filtered through the interstices by friction and collect together. Thunderbolts occur when the violent escape of elements of fire consists of those which are purer, smaller, more regular, and 'close-fitted,' to use his own term. Waterspouts occur when compounds of fire containing a particularly large proportion of void enclosed in places with a lot of void, and surrounded by membranes of a special sort, become solidified on account of their mixed composition and force their way down to the depths.

95. STRABO *Geography* I.1

The first to concern themselves with geography were people of that sort [viz. philosophers], Homer, Anaximander, and Hecataeus of Miletus, as we learn from Eratosthenes; also Democritus ...

96. a. Ps-PLUTARCH *Epitome* III.10.4–5 [= AETIUS III.10.4–5]

[On the shape of the earth] Leucippus says it is drum-shaped.

Democritus says it is disk-shaped in cross-section, and hollow in the middle.

b. EUSTATHIUS Commentary on *Iliad* VII.446

Democritus says that the inhabited earth is oblong.

c. AGATHEMERUS I.1.2

The ancients depicted the inhabited world as round, with Greece in the middle and Delphi in the middle of that, since it contained the navel of the

earth. The learned Democritus was the first to be aware that the earth is oblong, one and a half times as long as it is broad.

97. Ps-PLUTARCH *Epitome* III.12.1–2 [= AETIUS III.12.1–2]

Leucippus says that the earth slopes down towards the southern parts because of its loose texture in the south; the north is congealed by being frozen with the cold, while the opposite pole is burned up.

Democritus says that because the southern part of its surroundings is weaker, the earth grows and slopes down in that quarter. For the north is intemperate but the south is temperate; that is why it is weighed down in that quarter, where it is larger by its increase and by the plants which grow there.

98. Ps-PLUTARCH *Epitome* III.13.4 [= AETIUS III.13.4]

Democritus says that the earth was originally in irregular motion because of its smallness and lightness, but having become thicker and heavier in time it came to rest.

99. a. ARISTOTLE *De Caelo* 294b13–23

Anaximenes and Anaxagoras and Democritus say that its [i.e., the earth's] breadth is the cause of its remaining stationary, for it does not cut the air underneath, but covers it like a lid. Broad bodies appear to do that; things of that kind are not easily moved by the wind because of their resistance. So because of its breadth the earth acts in that way on the air underneath it (which remains compressed beneath because it lacks sufficient space to move to), like water in a clepsydra.[87] And they cite much evidence to show that air can support considerable weight when it is cut off and remains in position.

b. PHILOPONUS Commentary on *Physics* 262.8–13

The swirl of the cosmos [cf. **77a**] carries round the air enclosed in it. And as that air is continuous with the earth and everywhere in contact with it, it does not allow it to fall, but keeps it motionless, like people who whirl round vessels full of water so fast that they do not spill any.

c. Ps-PLUTARCH *Epitome* III.15.7 [= AETIUS III.15.7]

Parmenides and Democritus say that the earth is equidistant in every direction [i.e., from the circumference of the universe] and that it remains in equilibrium because there is no reason for it to go in one direction rather than another.[88] That is why it is shaken, but does not move.

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87 A device for lifting water, similar to a pipette.

88 See commentary 'Science and Mathematics,' p. 196.

100. SENECA *Natural Questions* V.2

Democritus says 'When there are many corpuscles (which he calls atoms) in a narrow space of void, wind results. But on the other hand there is a quiet and placid state of the air when there are few corpuscles in a large void. For just as in a square or street one can walk without disturbance as long as few people are about, but when a crowd comes together in a confined space there is a commotion as people bump into one another, so in the space which surrounds us, when many bodies fill a small space, they necessarily collide, knock one another back and forth, and get tangled and pressed together, which gives rise to wind, as those bodies which were jostling together flow and move in different directions for a long time. But when a few bodies travel about a large space, they cannot ram one another or get knocked about.'

101. ARISTOTLE *Meteorology* 365b1–7

Democritus says that when the earth is full of water and receives a great deal more in rain it is shaken by that; for when it is over-full and the hollows cannot take any more the water which is forced back produces earthquakes, and when it dries out and draws water from the fuller parts into those which are empty, the impact of the water changing place causes motion.

[Cf. ALEXANDER Commentary on the above 115.13–20, 116.10–11; AETIUS III.15.1; SENECA *Natural Questions* VI.20.]

102. a. Ps-PLUTARCH *Epitome* IV.1.4 [= AETIUS IV.1.4]

[On the rising of the Nile] Democritus says that when the snow in the northern parts is melted at the time of the summer solstice clouds are condensed from the vapour; and when they are driven to the south and to Egypt by the Etesian winds[89] they produce violent rains which fill the lakes and the river Nile.

b. SCHOLIAST on APOLLONIUS RHODIUS IV.269

Democritus ... the scientist says that the Nile receives the influx from the sea which lies to the south, and that the water turns sweet because of the distance and the length of the journey and the evaporation in the heat; which is why, he says, it has the opposite taste.

103. HIBEH PAPYRUS 16.62 [from Egypt, third century BC]

Democritus ... says that in liquids, as in the universe as a whole, like is sorted out together with like as a residue of putrefaction, and it is by

89 Lit. 'annual' winds, blowing from the north in the Mediterranean in summer.

this process of congregation of like elements that the sea and other salty substances are formed. That the sea is composed of elements of the same kind is clear from other cases; for frankincense, brimstone, silphium, alum, asphalt, or any other remarkable and unusual substance is not found in many places on earth. This, if none other, was an obvious theory for him to propose, since he makes the sea a part of the world, and says that the most astonishing and paradoxical works of nature come about in the same way, as there are not many differences among the elements composing the earth. Since he explains tastes through the shapes [sc. of the atoms], and saltiness as produced by large atoms with many angles, it was perhaps not unreasonable that saltiness should come about in the same way both on land and in the sea.

104. ARISTOTLE *Meteorology* 356b9–10

To think that it [i.e., the sea] is decreasing in size, as Democritus says, and that it will disappear in the end, seems no different from the fables of Aesop.

[Cf. ALEXANDER Commentary on the above 78.12–79.33.]

105. AELIAN *On the Nature of Animals* IX.64

Aristotle, and before him Democritus, and Theophrastus as well say that fish are nourished, not by salt water, but by the fresh water which is in the sea.

PSYCHOLOGY

106. a. ARISTOTLE *De Anima* 403b25–404a16

The animate seems to differ from the inanimate primarily in two respects, motion and perception. We have more or less inherited these two marks of the soul from our predecessors. For some say that the soul is chiefly and primarily the cause of motion, and as they believed that what was not itself in motion could not move anything else, they conceived the soul as something in motion. Which is why Democritus says that it is hot, a sort of fire; for while there are infinitely many shapes, i.e., atoms, he says that the spherical ones compose fire and the soul (like the so-called motes in the air, which are seen in sunbeams coming through windows);[90] the total collection of atoms he calls the elements of the whole of nature,

90 In some accounts of Democritus' atomism preserved in medieval Arabic authors the motes in the air are identified with atoms, rather than serving, as in Aristotle (probably following Democritus himself), as an illustrative analogy. The evidence is presented by Strohmaier 71; see also Maccio 66, Daiber 120.

as does Leucippus, but the spherical ones compose the soul, because such 'rhythms' [= shapes] can most easily penetrate through everything and move the others, being themselves in motion. They conceive that it is the soul which gives motion to animals. This is why breath is a mark of life; for the surroundings compress the bodies of animals and squeeze out the atoms which cause motion because they are themselves never at rest, but help comes from outside as other atoms of the same kind are breathed in, for they prevent the atoms which are in the body from being dispersed, by helping to restrain the compressing and congealing force. And as long as they can do that they stay alive.

[Cf. PHILOPONUS Commentary on the above 68.20–69.5.]

b. ARISTOTLE *De Partibus Animalium* 652b8–15

Some writers assert that the soul is fire or some such force. This, however, is merely a crude assertion, and it would perhaps be better to say that the soul is embodied in some substance of a fiery character. The reason for this being so is that of all substances there is none so suitable for assisting the operations of the soul as that which possesses heat. For nutrition and causing motion are functions of the soul, and it is by heat that these are most readily brought about. To say then that the soul is fire is much the same as to confuse the auger or the saw with the carpenter or his craft, simply because the work is done when the two are near one another.

c. ARISTOTLE *On Respiration* 470b28–30; 471b30–472a18

Democritus of Abdera and certain others who have spoken about breathing have not discussed the other animals [sc. than those with lungs], but appear to say that all breathe. ...

Democritus says that breathing has the effect of preventing the soul from being squeezed out, but he does not say that nature acts for that purpose; in general he, like the other natural scientists, makes no use of that cause. He says that the soul and the hot are identical, consisting of spherical atoms, and when these are separated out by the squeezing of the surroundings, help comes from breathing. For in the air there are a great number of atoms of that kind, which he calls mind and soul; when one breathes in these come in along with the air and, by resisting the pressure, prevent the soul which is in the animal from slipping out. That is why life and death depend on breathing in and out. For when the pressure of the surroundings gets the upper hand and there is no further external supply to resist it, i.e., when the animal cannot breathe in, then death occurs; for death is the loss of those atoms from the body through the pressure of the surroundings. But he gave no explanation of the reason why everything must die, not in a chance fashion, but naturally of old age, or by violence contrary to nature.

[Cf. Ps-ARISTOTLE *On Breath* 482a28–30; AETIUS IV.3.5, 7; ANON. *On the Soul* (= *CPF* I** 43.2T); CICERO *Tusculan Disputations* I.11.22, I.18.42; HERMIAS *Mockery of the Pagan Philosophers* 2; MACROBIUS Commentary on Cicero's *Somnium Scipionis* I.14.19; NEMESIUS *On the Nature of Man* 2.]

107. a. ARISTOTLE *De Anima* 404a24–31

Anaxagoras too says that soul is the cause of motion, and so does anyone else who says that mind sets everything in motion; but that view is not exactly the same as that of Democritus. For he says that soul and mind are simply the same thing, for truth is what appears, which is why Homer was right to describe Hector as 'lying thinking other things';[91] he does not then treat the mind as a capacity to achieve the truth, but says that soul and mind are the same thing.

b. ARISTOTLE *De Anima* 405a8–13

Democritus' explanation of either attribute [i.e., the soul's being a source of motion and the seat of intelligence] is more subtle [i.e., than that of his predecessors]. He says that the soul is the same as the mind, and is composed of the primary, indivisible bodies, and is a source of motion because of their smallness and shape. He says that the sphere is the most mobile of shapes, and that mind and fire are of the same nature.

[Cf. PHILOPONUS Commentary on the above 83.24–8; AETIUS IV.5.12.]

108. ARISTOTLE *De Anima* 406b15–25

Some say that the soul moves the body in which it is in the same way as it is itself moved, e.g., Democritus, who says much the same as the comic dramatist Philippus.[92] He describes Daedalus as making the wooden statue of Aphrodite move by pouring in quicksilver. Democritus' view is similar; he says that the indivisible spheres are in motion because their nature is such that they are never still, and they move the whole body by dragging it along with them. We shall ask whether that also causes it to be at rest; but how it could do so is difficult or rather impossible to say. But the soul does not seem to move the body in that way at all, but through choice and thought.

[Cf. THEMISTIUS Commentary on the above 18.37–19.14.]

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91 *Iliad* 23.698 (also cited at *Metaphysics* 1009b28–30); in fact the line applies not to Hector but to Euryalus. Democritus' text of Homer may have differed from ours, and in any case he and Aristotle no doubt quoted from memory.

92 Son of Aristophanes, according to a scholiast on Plato *Apology* 19c. See *RE* xix.2, 2338–9.

109. a. ARISTOTLE *De Anima* 409a10–14

It would seem to make no difference whether one speaks of arithmetical units or small bodies; for if Democritus' spheres are turned into points, as long as they remain magnitudes, there will be one part of the magnitude which moves and another which is moved, as is the case with continuous quantity.

b. ARISTOTLE *De Anima* 409a31–b11

The consequence is ... that they [i.e., those who hold that the soul is a self-moving number] on the one hand say the same as those who make it a fine-textured body, and on the other bring in absurdities of their own, as with Democritus' account of how motion is imparted by the soul. For if the soul is in the whole of the perceptive body, there must be two bodies in the same place, if the soul is a body. ... And it will result that the animal is moved by the number in the way that Democritus said it moves it; for what is the difference between talking of small spheres or of large units, or in general of units in motion? Either way it is necessary that the animal should be moved by the motion of those things.

[Cf. THEMISTIUS Commentary on the above 31.20–32.15.]

110. a. Ps-PLUTARCH *Epitome* IV.4.6 [= AETIUS IV.4.6]

Democritus and Epicurus say that the soul has two parts, the one containing the intellect seated in the chest, and the non-rational scattered through the whole structure of the body.

b. Ps-PLUTARCH *Epitome* IV.5.1 [= AETIUS IV.5.1]

[On the controlling element in the soul] Plato and Democritus say that it is in the whole of the head.

c. THEODORETUS *Cure for the Ills of the Greeks* V.22

[On the same topic] Hippocrates, Democritus, and Plato say that this is situated in the brain.

d. PHILOPONUS Commentary on *De Anima* 35.12–14

Democritus says that it [i.e., the soul] has no parts nor a plurality of faculties; he says that thought is the same as perception and that these are produced by a single faculty.

[Cf. THEMISTIUS Commentary on *De Anima* 35.6–7; TERTULLIAN *De Anima* 12.6.]

e. SEXTUS *Against the Mathematicians* VII.349

Some say that it [i.e., thought] occurs throughout the whole body, e.g., some people who follow Democritus.

f. LUCRETIUS III.370–4

On this point you could not accept what the holy opinion of the man Democritus lays down, that the elements of body and mind are disposed alternately, one by one, and so bind the limbs together.

111. Ps-PLUTARCH *Epitome* IV.7.4 [= AETIUS IV.7.4]

Democritus and Epicurus say that the soul is mortal, and that it perishes with the body.

[Cf. LACTANTIUS *Institutiones Divinae* III.18.6, VII.7.12, 8.8, 13.7; THEODORETUS *Cure for the Ills of the Greeks* V.24.]

112. a. CICERO *Tusculan Disputations* I.34.82

Suppose that the mind perishes as does the body; surely then after death there will be no pain or any sensation at all in the body. At any rate no one says so, though Epicurus charges Democritus with doing so, but Democritus' followers deny it. So no sensation is left even in the mind, since it itself is nowhere.

b. Ps-PLUTARCH *Epitome* IV.4.7 [= AETIUS IV.4.7]

Democritus says that everything contains a sort of soul, including corpses, which is why it is always apparent that they have a sort of warmth and perception, though most of it is breathed out.

[Cf. IV.9.20; ALEXANDER Commentary on *Topics* 21.21.]

c. TERTULLIAN *De Anima* 51.2

Yet in the *Republic*[93] ... Plato mentions that a certain man's corpse lay unburied for a long time without any decomposition, preserved, so he claims, by the individuality of the soul. On this point Democritus mentions the growth of nails and hair for some time after burial.

d. PROCLUS Commentary on Plato's *Republic* II.113.6 Kroll

Stories of people who appeared to have died and then came back to life were collected by many of the ancients including the scientist Democritus in his writings On Hades [cf. **40** (46)]. ... Death was not, as it seemed to be, the extinction of all life in the body, but it was driven out perhaps by a blow or an injury, while some links with the soul were left still rooted in the region of the marrow and the heart retained some sparks of life hidden in its inmost regions. And as these remained intact the body was still adapted for life and subsequently regained the life which had been extinguished.[94]

[Cf. CELSUS II.6; PLINY *Natural History* VII.55.189–90; VARRO *Satires* fr. 81.]

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93 614b. The 'certain man' is Er the Pamphylian, whose account of the fate of the soul after death ('the myth of Er') concludes the *Republic*.

94 See Gottschalk 65.

Perception and the Senses

113. THEOPHRASTUS *On the Senses* 49–83

Regarding perception, Democritus does not make clear whether it comes about through similarity or dissimilarity.[95] If he makes perception come about through alteration, it would appear to be through difference; for like is not altered by like. But again, perception and in general alteration are instances of being acted on; and it is impossible, he says, for things which are not the same to be acted on, but even if different things act [sc. on one another] they do so not in so far as they are different, but in so far as the same attribute belongs to them, i.e., they are alike. So on this point it is possible to take either view. An attempt at a detailed discussion of each sense follows.

(50) He makes sight occur by means of the image; his account of this is original, for he says that the image is not immediately produced in the eyeball, but the air between the sight and the thing seen is compacted by the seer and the thing seen and an impression is made on it, as everything is always giving off an effluence.[96] This mass of air, which is solid and of a different colour, is then imaged in the eyes, which are moist; a dense body does not take the image, but a moist one lets it pass through. That is why moist eyes are better at seeing than hard ones, provided that the outer coating is as fine[97] as possible, and the inside as porous as possible

95 Theophrastus introduces his discussion, somewhat artificially, by setting up a puzzle (*aporia*) in the manner of Aristotle. On the one hand, some early philosophers held that like is known by like (Empedocles DK 31 B109, Sextus *Against the Mathematicians* VII.92); on the other, perception is a form of alteration, and in alteration (in Aristotelian theory) the changer and the thing changed must be unlike to start with (e.g., heating occurs when a hot thing makes something else change from cold to hot). Democritus' own position, which Theophrastus states clearly in the sentence 'But again ... alike,' is simply that all change is brought about by the action of one body on another (see von Fritz 72, p. 607), which is compatible with the Aristotelian analysis of alteration. It is unclear whether Democritus accepted any version of the Empedoclean principle. Sextus *Against the Mathematicians* VII.116 says so, but the passage which he cites (**D6**) has nothing to do with perception, but with the quite distinct phenomenon of the sorting of like with like in various situations. See, however, the last sentence of (50), with n. 99 below.

96 See commentary 'Psychology,' pp. 208–11.

97 The mss. have 'fine and dense.' I follow von Fritz 72, p. 610 in deleting 'and dense' (*hōs puknotatos*) a) because it contradicts 'fine' (*leptos*, 'fine-textured,' as opposed to *puknos*, 'dense, closely packed'), b) because Theophrastus has just said that a dense body does not receive the image. For a defence of the ms. reading see Baldes 58, pp. 88–9.

without any dense, strong flesh or thick, greasy liquid,[98] and the veins in the region of the eyes are straight and free of moisture, so that they match the shape of the impressions; for everything most readily recognizes things of the same kind as itself.[99] (51) First of all, the making of an impression on the air is absurd; for the thing on which the impression is made must be dense, and must not be scattered, as he himself says in comparing the making of this sort of impression to pressing something into wax. Further, in so far as water is denser, it is easier to make an impression in it; but one sees less in water, whereas one ought to see better. In general, why should someone who posits an effluence of the shape of the object, as in the writings about forms,[100] also posit the making of an impression? For the *eidōla* [i.e., the physical effluences from the perceived object] are themselves imprinted. (52) But if this does happen, and the air is moulded like wax by being pressed and condensed, how does the image come about, and what kind of image is it? It is clear that the imprint will be facing the thing seen, as in other cases. But then it is impossible for the image to be reversed, unless the imprint is turned round. He must show what will do that and how; for otherwise sight will not occur. Further, when several things are seen in the same place, how will there be several imprints in the same air? And again, how is it possible for us to see one another? For the imprints must necessarily collide, as each is face to face with its source. So that is a problem. (53) And in addition, why does each person not see himself? For the imprints would be imaged in one's own eyes, just as much as in those of others, especially if people are face to face and the same thing happens as with the echo; for he says that the voice is reflected back to the speaker. The whole theory of an impression on the air is absurd. For from what he says it follows necessarily that every body leaves its impression and that many exchange impressions, which would get in the way of sight, and is

98 I translate the ms. text; Kranz, following Diels, emends to 'full of thick, greasy liquid.' As Stratton 70 points out (p. 187, n. 133, followed by Sassi 69, p. 102, n. 39), this gives the wrong sense, since on the account given here thick liquid in the eye would impede, not further, the transmission of images.

99 The construction indicates that this is a statement of Democritus', not a comment by Theophrastus. It may mean no more than that the *eidōlon* has to fit into a channel in the eye (so von Fritz 72, p. 611). But perhaps this is a trace of his acceptance of the Empedoclean principle (see above); if so it is an isolated one.

100 The reference is presumably to some of Democritus' writings on perception. The title *On Forms* (*Peri Tōn Eidōn*), is not attested, but he is reported as applying the equivalent term *ideai* ('shapes') to the atoms (**D7**; **206**). In his edition of 1821 Schneider emends to *On Images* (*Peri Tōn Eidōlōn*) which is attested in Thrasyllus' catalogue (**40** (47) VI.2).

unreasonable for other reasons too. Further, if the impression remains in the air, one ought to be able to see bodies which are not visible or near, if not at night, at least in daylight. Yet it is no less likely that the imprints should remain at night, since the air is cooler.[101] (54) But perhaps the sun makes the image by as it were bringing the light to the eye, as he seems to mean. For it is absurd to describe the sun as pushing the air away and moulding and condensing it, as he does; rather it naturally penetrates it. And it is absurd to ascribe the sense not merely to the eyes, but to the rest of the body as well; for he says that the eye must contain empty space and moisture to be able to receive it to a greater extent and to pass it on to the rest of the body. And it is irrational to say that things of the same kind are most readily seen, but then to explain the image as an effect of contrasting colours, since things alike in colour are not seen in an image. And though he tries to say how size and distance are seen in an image, he does not explain it. (55) So his attempt to say some original things about sight simply creates more problems.

His account of hearing is similar to that of the others; air entering a void creates motion, except that it comes in all over the body, but especially and most of all through the ears, because there it travels through the most void and has the least delay. That is why one does not perceive with the whole body, but only there.[102] And when it gets inside, its speed causes it to disperse; sound occurs when the air is condensed and penetrates with force. Just as he makes external perception come about by contact, so with internal. (56) One hears most clearly when the external coating is dense[103] and the veins are empty and as far as possible free of moisture and well bored throughout the body, and especially in the area of the brain and the organs of hearing, and in addition the bones are dense and the brain is properly adjusted and its surroundings are as dry as possible; in those circumstances the sound is concentrated and comes in through the large amount of void, which is free from moisture and well-bored, and is dispersed swiftly and regularly through the body and does not escape. (57) In its unclarity of exposition this theory is like the others. But it has its own particular absurdity in having the sound come in all over the body and, in the case

101 I translate Wimmer's emendation *empsuchroteros* of the mss.' *empsuchoteros* 'more alive,' which, *pace* Beare 59, pp. 28–9, n. 2, appears to give no satisfactory sense.

102 On the roles of the specific sense organs and of the whole body in Democritus' theory, see commentary 'Psychology,' pp. 203–4.

103 There is no inconsistency with the assertion in (50) that the outer coating of the eye must not be dense if it is to let the *eidōla* through. Sound atoms come into the ear through the large amount of void provided by the passages into the inner ear, and resonate within the dense walls of the cavity of the ear and the skull.

where it has come in through the ears, in having it permeate the whole, as if perception was the work, not of the organs of hearing, but of the whole body.[104] For even if something happens to it as a concomitant of hearing, it does not therefore perceive. He treats all the senses in the same way, and not only them, but the soul too.

This is his account of sight and hearing; about the other senses he says much the same as the majority. (58) About thought he said merely that it occurs when the constituents of the soul are properly balanced;[105] when one gets too hot or too cold, then he says change takes place. That is why it was a good idea of the ancients that one can 'think other things.'[106] It is clear, therefore, that he explains thought by the constitution of the body, which is perhaps consistent on his part, since he makes the soul out to be a body. These and similar opinions of his about perception and thought are more or less derived from earlier thinkers.

(59) The question of the nature of the objects of sense in general, and of what each one is in particular, is ignored by the others. Among the objects of touch they speak about the heavy and light and the hot and cold, e.g., that the thin and fine is hot and the dense and thick cold, which is how Anaxagoras distinguishes air and ether. They distinguish the heavy and the light in much the same way and also by their upward and downward motions, and in addition they say that sound is a movement of the air and that smell is an effluence. Empedocles also discusses colours and says that white is the colour of fire and black that of water; the others say merely that white and black are the primary colours, of which the others are mixtures. Even Anaxagoras spoke superficially about them. (60) Democritus and Plato discussed them most fully, for they distinguish them in detail; except that Plato does not deprive the objects of sense of their own nature, whereas Democritus reduces them all to states of the sense. We shall not discuss which of these views is true, but let us try to set out how far each pursued the topic and what distinctions he made, having first given an outline of each view in its entirety. Democritus does not give a uniform account of them

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104 For Democritus, perception in the sense of the registering of a stimulus in consciousness *is* the work of the whole body, since the mind permeates the body. The role of the sense organ is simply to transmit the stimulus to the mind. While that gives Democritus a reply to Theophrastus' objection, it raises the deeper problem discussed in the commentary of the capacity of the theory to differentiate thought from perception.

105 Adopting Diels' emendation *kata tēn krēsin*, lit. 'in respect of the mixture' [sc. of the constituents of the soul]. The ms. reading *meta tēn kinēsin* (adopted by Guthrie 9, pp. 451–3 and Sassi 69, p. 188) gives the sense 'properly balanced after the motion' [sc. the motion within the soul produced by sensory stimulation].

106 See **107a**.

all, but differentiates some by size, some by shape, and some by order and arrangement. Plato ascribes almost all to states and [i.e., states of] the sense. So each seems to contradict his assumption, (61) as Democritus makes them out to be states of the sense but distinguishes them with respect to their own nature,[107] while Plato makes them out to be things in their own right but ascribes them to states of the sense.

Democritus distinguishes heavy and light according to size; for if they were separated from one another individually, whatever their differences in shape, their weight would be in proportion to their size. Of course in compounds the lighter is the one which contains the more void, the heavier the one which contains less; he says so in some places. (62) But elsewhere he says that the light is simply the fine. His view on hard and soft is very similar; he says that the hard is the dense, and the soft is the loose-textured, and the various degrees are in proportion. The hard and soft, heavy and light differ in respect of position [sc. of atoms] and of inclusion of void. That is why iron is harder and lead heavier; for iron is irregularly constituted, with large empty spaces in many places, but some areas densely packed, and absolutely it has more void. But lead, though containing less void, is regularly arranged throughout; consequently it is heavier but softer than iron. (63) That is his account of heavy and light and hard and soft. None of the other sensible qualities has any nature of its own, but all are states of the sense when it is altered so as to give rise to an appearance. For there is no nature belonging to hot or cold, but change in shape [sc. of the thing perceived] brings about alteration in us; a concentrated effect dominates each individual, whereas an effect which is spread out over time is not noticed. The evidence for this is that things do not naturally seem the same to all creatures, but what is sweet to us is bitter to other creatures, sharp-tasting to others, pungent to others, sour to others again, and the same for other cases. (64) Further, they [i.e., observers] vary in their judgments according to their different states and to their ages; which makes it clear that their disposition is the cause of how things seem to them. That, omitting qualifications, is how one should regard the objects of sense. Of course, these too [i.e., states of observers] are, like everything else, ascribed to the shapes [sc. of the atoms]. Though he

107 An unsympathetic description of Democritus' attempt to describe the atomic structures underlying the various secondary qualities. Theophrastus suggests that Democritus vacillates, as Locke sometimes does, between treating the secondary qualities as sense impressions on the one hand and as structural features of atomic aggregates on the other. Perhaps he did; but it is possible that Theophrastus is misrepresenting a more careful presentation of the theory, in which things are said to possess secondary qualities, i.e., powers to evoke 'states of the sense' in virtue of their atomic structures.

does not set out the shapes underlying them all, but rather those underlying flavours and colours, and of these flavour is given the more precise account, in which the appearance is referred to [the state of] the individual.

(65) Sharp flavour consists of small, fine-grained atoms of an angular, zigzag shape. Because these are pungent they penetrate everywhere, and because they are rough and angular they compress and contract, thus creating empty spaces in the body and heating it; for the more void a thing contains, the hotter it becomes. Sweet consists of round atoms which are not too small, and therefore generally flow through and permeate the entire body, but not violently or quickly. But it purges other people, since as it permeates it moistens the other atoms and makes them move about; and as they get moistened and moved from their respective positions they flow into the gut, which offers the easiest movement as it contains most void. (66) Sour[108] consists of large, many-angled atoms with the minimum of roundness; when these enter the body they stop up the veins and prevent them from flowing; that is why the gut ceases to function. Bitter consists of small, smooth, round atoms with spikes on the circumference as well; that is why it is sticky and viscous. Salty consists of large atoms which are not round, in some cases uneven <but in most cases not>;[109] that is why it is not composed of zigzag atoms (by uneven he means atoms which overlap[110] and get entangled with one another). They are large because the salt comes to the surface; for if they were small they would be mixed in with all the rest as they were knocked about by those surrounding them. They are not round because salty things are rough and round things smooth. They are not uneven because they are not interlocked;[111] that is why it is powdery. (67) Pungent is small, round, and angular, but not uneven. For what is pungent has many projections and makes things hot by its roughness and flows through them because it is small, round, and angular; for what is angular

108 *Oxus*, lit. 'sharp,' is the regular term for the acid flavour of vinegar, etc. 'Sour' translates *struphnos*, which LSJ renders 'sour, harsh, astringent.' It is clearly treated by Theophrastus as a distinct flavour from *oxus*, though it picks out something in the same range, since it too can be applied to pickles, etc. It is close in sense to *austēros*, 'harsh,' and is applied metaphorically to people of harsh or austere temperament. Clearly we do not know precisely how Democritus and after him Theophrastus distinguished tastes; any rendering must be to some degree conventional.

109 Supplementation by Diels.

110 I translate the ms. reading *parallaxin*. DK's emendation *peripalaxin* should mean 'being scattered about,' which does not seem to be the required sense. McDiarmid 34, p. 259 suggests *epallaxin* 'interlocking.'

111 I translate the ms. reading *periplattesthai*. DK read *peripalattesthai*, the passive infinitive form of the verb of which *peripalaxis* (see previous note) is the nominalization. McDiarmid 34 reads *periplekesthai*, giving the same sense as *periplattesthai*.

has that character. He gives a similar account of the properties of each flavour, referring them to the atomic shapes. None of them is found pure and unmixed with others, but in everything there are many, and the same thing contains smooth, rough, round, sharp, and the rest. The shape which occurs most frequently among the constituents is the one which determines how the thing is perceived and what properties it has, though that also depends on the disposition of whatever observer it comes into contact with; for there are considerable differences there too, since sometimes the same feature produces opposite effects, and sometimes opposite features produce the same effect. (68) That is his account of flavours.

It would appear to be absurd first of all not to give the same cause for everything alike, but to ascribe heaviness and lightness, softness and hardness to largeness, smallness, looseness of texture, and density, while distinguishing hot and cold and the rest by their shapes. And then it is absurd to postulate intrinsic natures of heavy and light, hard and soft (for largeness, softness, looseness, and density are not relative), and yet make hot, cold, etc. relative to perception, while reiterating that the shape which underlies heat is the sphere. (69) But in general the greatest contradiction, which pervades the whole theory, is his both making them states of perception and at the same time distinguishing them by their shapes, and saying that the same thing appears bitter to some, sweet to others, and different to yet others. For it is impossible for the shape to be a state, or for the same thing to be spherical to some and differently shaped to others (yet perhaps that is how it has to be, if it is sweet to some and bitter to others), or for the shapes to change according to our dispositions. It is simply the case that shape is intrinsic, but sweet and sensible qualities in general are relative and dependent on other things, as he says. And it is absurd to require that the same appearance should be presented to everyone who perceives the same thing, and should be the test of their truth, when he has previously said that things appear differently to those who have different dispositions, and again that none has more truth than any other.[112]

(70) It is reasonable that the better should have more truth than the worse and the healthy more than the sick, for they are more in accordance

112 Theophrastus puts his finger on a crucial weakness in Democritus' theory. If all appearances are true (see commentary 'Epistemology,' pp. 216, 221–2) and the same atomic structure can appear differently to different observers, it is impossible to identify a particular structure-type as *the* structure underlying a particular appearance-type (e.g., sweetness). For that the appearance-type has to be relativized to the perceptions of some privileged observer, e.g., the person in good health (see (70)), but the thesis that all perceptions are true rules out such relativization.

with nature. Further, if there is no nature of the objects of sense because they do not appear the same to everyone, it is clear that there will be no nature of animals or other bodies; for there is not [universal] agreement in judgment on those either. And again, even if sweet and bitter are not tasted by everyone in the same circumstances, all the same the nature of sweet and bitter appears the same to everyone, as he himself would appear to testify. For how could what is sweet to us be bitter or sour to other perceivers if there were no determinate nature of these qualities?

(71) Further, he makes it fairly clear in what he says that each of them comes to be and is in reality, and it is only in the special case of bitterness that he says they have a share in consciousness. So for these reasons it would appear contradictory not to postulate any nature for the sensible qualities, and in addition there is the point made earlier, that it is contradictory for him to ascribe a shape to bitterness and the other qualities, but to say that they have no intrinsic nature. For either that should be true of none, or of those as well, since all have the same cause. Further, the hot and the cold, which they posit as principles, ought to have a nature, and if they do, then so should the rest. But now he posits a nature of hard and soft and heavy and light, which appear to be predicated no less relatively, but none of hot or cold or the rest. But yet once he distinguishes heavy and light by size, necessarily all the simple bodies have the same motive impulse, so that they will all be of a single matter and the same nature. (72) On this subject he seems to follow those who give a general account of thought as coming about by alteration, which is the most ancient view; for all the early thinkers, poets and philosophers alike, describe thought in terms of [the thinker's] disposition. In ascribing a shape to each of the flavours he assimilates it to a sensory capacity; but that ought to be produced not only by them, but also by the sense-organs, especially if they [i.e., the flavours] are states of the latter. For it is not the case that everything spherical, or of any other shape, has the same capacity, so he ought to have distinguished them in terms of their subjects as well, i.e., whether they are produced by likes or unlikes, and how the alteration of the sense comes about, and should moreover have given the same account of all tactile qualities, not merely those of taste. But either they have some difference from flavours, which he should have stated, or else a similar account, which could have been given, has been omitted.

(73) On colours, he says that there are four simple ones. White is what is smooth. For whatever is not rough or shadowy or difficult to penetrate, anything like that is bright. Bright things must also have straight pores to let the light pass through. Hard, white things are composed of shapes like the inner surface of shells, so they are shadowless and shining, with straight

pores. Those which are friable and brittle[113] are composed of spherical atoms positioned obliquely in pairs, in an arrangement which is practically uniform overall. They are friable because the connections hold between small groups of atoms, brittle because they are uniformly positioned, and shadowless because they are smooth and flat. The more exclusively things are composed of these shapes, unmixed with others, and the more they display that position and arrangement, the whiter they are. (74) White consists of shapes of those kinds and black of the opposite, rough, uneven, and dissimilar, for they cast shadows and their pores are not straight or easily penetrable. Further, their effluences are dull and confused; effluences differ relative to appearances, which are produced by the reception of impressions of different kinds made on the air. (75) Red consists of the same sort as hot, only bigger; for the bigger the combinations of similar atoms are, the redder the thing is. The evidence that red consists of that sort of atoms is that we go red when we get hot, and so do other things that are burning, until they catch fire. And things composed of large atoms, such as flame and coal, are redder than green or dry wood. And so are iron and other things when they are burning; the brightest are those which have the most and the finest fire, while those which have less, thicker in texture, are redder, as the fine-textured is hot. Greenish-yellow[114] consists of a mixture of solid and void, the colour varying according to their position and arrangement. (76) The simple colours use these shapes; the less each is mixed, the purer it is. The other colours are produced by mixture of these. Thus gold and bronze and similar colours come from red and white; they get their brightness from white and their reddish tinge from red; for when they are mixed the red falls into the gaps in the white. If one adds greenish-yellow, then one gets the most beautiful colour, but the additions of greenish-yellow must be small; one cannot add large amounts to red and white combined in that way. Colours vary with larger or smaller additions. (77) Purple consists of white, black, and red, the largest proportion being red, the smallest black, and the middle one white. That is why it is pleasant to sense. That it contains black and red is obvious to the eye, and that it contains white is shown by its brightness and transparency, which are produced by white. Dark blue consists of very black and greenish-yellow, with a larger proportion of black; leek-green of purple and dark blue, or greenish-yellow and purplish.

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113 von Fritz 72, p. 617, n. 56 suggests *euthupora* 'having straight pores or channels' instead of the mss.' *euthrupta* 'brittle.'

114 'Greenish-yellow' renders *chlōros*, a simple colour word, designating the colour of fresh young plants. Its application straddles our green and yellow, including at one extreme honey, egg-yolks, and sand, and at the other emeralds.

Sulphur is that colour, with a touch of brightness. Blue consists of dark blue and fiery colour, a mixture of round and needle-shaped atoms, so that you get a sheen on the black. Nut-brown consists of greenish-yellow and blueish; but if white is mixed in, it becomes flame-coloured, since that is lacking in shadow and black is excluded. When red is mixed with white it makes greenish-yellow shining, not black; that is why growing plants are greenish-yellow at first, before they get heated and permeated. That is as many colours as he discusses, but he says that infinitely many colours and flavours are produced by mixture, adding and subtracting and mixing more of one and less of another; none of these will be [exactly] like any other.[115]

(79) First of all there is a problem in positing several principles; the others posit only white and black, as the only simple colours. Then there is a problem in not assigning a single shape to white things, but different shapes to hard and friable things; for it is not plausible that there should be another cause [sc. of sameness of colour] in the case of things which differ in tactile respects, or that shape, rather than position, should cause the difference. For round things, and things of absolutely any shape, can cast shadows on one another, as we see from what he himself says about smooth things which appear black. They appear like that because they have the same structure and arrangement as black things. And then there are rough things which are white. They are composed of large atoms whose combinations are not round, but stepped, and the shapes of the atoms are combined like an ascent or a mound thrown up in front of a wall; that arrangement casts no shadow and does not inhibit the brightness.

(80) Moreover, how does he explain the fact that in some animals the white parts turn black, if they are so placed as to cast a shadow? In general he seems to describe the nature of translucency and brightness rather than of white, since being easily penetrable and not having zigzag pores is a mark of the translucent, but how many translucent things are white? Further, that the pores in white things are straight and those in black zigzag has to

115 As presented by Theophrastus, Democritus has no unitary theory of colour. Of the four primary colours, white and black are apparently explained in terms of translucency and opacity; white things are those whose atomic structure makes them translucent, black those whose structure makes them opaque. (For detailed discussion see Baldes 58.) On the other hand, he makes no attempt to explain the other primary colours, red and greenish-yellow, in terms of light and shade. Red is simply the colour of moderately hot things (since extremely hot things are white- rather than red-hot (75)), while he gives no specific account of greenish-yellow at all. The accounts of compound colours appear to be based on the experience of mixing pigments. Theophrastus deals concisely with some of the inadequacies of the treatment of colour in (79)–(82).

be understood as assuming that the intrinsic nature [sc. of colour] comes in [sc. to the object through the pores]. He says that we see by means of the effluence and the image on the eye; but if so, what difference will it make whether the pores are parallel to one another or zigzag? Nor is it easy to understand how there can be an effluence from the void; so he ought to explain that. He seems to explain white as caused by light or something else; that is why he cites the density of the air as a cause of things' appearing black. (81) Further, it is not easy to grasp his account of black; a shadow is something black superimposed on white, so white is naturally primary. But at the same time he cites as causes not merely shadowing, but the density of the air and of the effluence which comes in [sc. to the eye] and the disturbance in the eye. But whether that occurs because the object is not transparent or for some other reason, and if so what, he does not make clear. (82) And it is absurd not to assign a shape to greenish-yellow, but merely to explain it by the solid and the void; for they are common to everything of whatever shape, but he ought as in the other cases to have given some specific explanation. If it is the opposite of red, as black is of white, it ought to have the opposite shape; but if it is not opposite, it would be astonishing if he did not make his principles opposites, as everyone agrees they are. Above all he ought to have said precisely which colours are simple and why some are compound and some uncompounded; for the greatest problem concerns the principles. But perhaps that is difficult; if someone could say which are the simple flavours, he would be better placed to solve it. He omitted any discussion of smell, except to say that a fine effluence from heavy things produces odour; but he did not say anything more on what its nature is or what acts on it, which is perhaps the most important point. (83) So Democritus leaves some things out.

114. STOBAEUS I.51.4, I.50.8 [= AETIUS IV.10.4–5]

Democritus says that there are more senses [sc. than five], bearing in mind non-rational animals and wise men and gods.

Democritus says that there are more senses than objects of sense, but since the objects of sense do not correspond [i.e., to the senses] their number is uncertain.[116]

115. a. STOBAEUS I.50.4 and 12 [= AETIUS IV.8.5 and 10]

Leucippus and Democritus say that perceptions and thoughts are alterations of the body.

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116 See commentary 'Psychology,' p. 205, n. 32.

Leucippus, Democritus, and Epicurus say that perception and thought occur when *eidōla* come from outside; neither of these happens to anyone without the impact of an *eidōlon*.

b. STOBAEUS I.50.22 [= AETIUS IV.9.6]

Empedocles, Democritus [and others] say that particular sensations occur when the pores are of the appropriate dimensions, so that the appropriate sensible object fits into each one.

116. ARISTOTLE *On Sense* 442a29–b24

Democritus and the majority of the natural scientists commit the most extreme absurdity in what they say about perception; they make all the objects of sense objects of touch. But if that is so, it is clear that each of the other senses is a sort of touch, and it is not difficult to see that that is impossible. Further, they treat common objects of the senses as if they were specific to particular senses; for size and shape and rough and smooth, as well as sharp and blunt as properties of bodies, are common objects of the senses, if not of all, at least of sight and touch. That is why one can be mistaken about them, but cannot be mistaken about the specific objects, e.g., sight about colour and hearing about sound. But some reduce the specific objects to them, e.g., Democritus, who says that white and black are the rough and the smooth, and reduces flavours to shapes. But the discrimination of the common objects is either not the function of any sense, or is the function of sight rather than any other. So if it is the function of taste rather than any other, it will be the function of the most precise sense to make the finest discriminations of every kind, so that taste ought to have had the finest discrimination of shape and the keenest perception of the other common objects. Further, all the objects of sense have opposites, e.g., black and white in colour and sweet and bitter in flavour, but no shape appears opposite to any other; to which polygon is round opposite? Further, since there are infinitely many shapes there must be infinitely many flavours; so why is one flavour perceived and another not?

[Cf. ALEXANDER Commentary on the above 82.23–85.10.]

117. ARISTOTLE *On Sense* 438a5–12

Democritus is right to say that it is water [sc. by which we see] but wrong to say that seeing is the image. That [i.e., seeing] occurs because the eye is smooth, and is not in the eye but in the perceiver. What happens is a case of reflection, but in general it seems that he says nothing clear about images and reflection. And it is absurd that it did not occur to him to inquire why the eye alone sees, but none of the other things in which images appear.

118. ARISTOTLE *De Anima* 419a13–17

[In vision] colour brings about a change in the transparent medium, e.g., air, and the sense-organ is changed by the activity of this continuous medium. For Democritus was not correct to think that if the intervening space was empty one would see acutely enough to see even an ant in the heavens; that is impossible.[117]

119. a. STOBAEUS I.52.1 [= AETIUS IV.13.1]

Leucippus, Democritus, and Epicurus say that seeing occurs through the penetration of *eidōla*.

b. ALEXANDER Commentary on *On Sense* 24.14–22

Democritus says that seeing is the reception of the image from the thing seen. The image is the form which is imaged in the eyeball, as in other transparent objects which are capable of retaining the image. He, like Leucippus before him and Epicurus and his followers later, thinks that *eidōla* flow off, similar in form to the things from which they flow (these are the visible things), and they impinge on the eyes of perceivers, and thus seeing occurs. He cites as evidence the fact that the image and *eidōlon* of the thing seen is always present in the eyeball of the person who sees, which is what seeing is.

c. ALEXANDER Commentary on *On Sense* 56.12–15

They explained seeing as due to *eidōla* of similar form emitted by visible things in a continuous flow and impinging on the eye. This was the view of Leucippus, Democritus, and their followers, who also explained the appearance of intermediate colours [i.e., colours intermediate between black and white] by the juxtaposition of things which are too small to be visible.

d. ALEXANDER *De Anima* (*Suppl. Ar.* II.136.16–17)

And how does the eye receive this [i.e., the mass of air compacted by the *eidōla*, cf. **113** (50)], and, further, how will it repeatedly receive a thing of that size? For seeing does not occur through the impact of a single *eidōlon*.[118]

[Cf. ALEXANDER Commentary on *On Sense* 60.15–17, 124.6–7; MACROBIUS *Saturnalia* VII.14.3–4.]

120. STOBAEUS I.16.1 [= AETIUS I.15.8 and 11]

Democritus says that by nature there is no such thing as colour, for the elements, the solid things and the void, are propertyless. The compounds made from them are coloured by 'contact,' 'rhythm,' and 'turning,' i.e.,

117 See commentary 'Psychology,' p. 209.

118 See Avotins 55.

arrangement, shape, and position; for the appearances arise from these. There are four varieties of these apparent colours, white, black, red, and yellow.

Some say that the atoms are all colourless, but that sensible properties come from things which are propertyless but theoretically describable.

121. STOBAEUS I.52.15 [= AETIUS IV.14.2]

Leucippus, Democritus, and Epicurus say that mirror images come about through the impact of *eidōla*, which travel from us and are combined in reverse on the mirror.

[Cf. ANON. Commentary on Plato's *Alcibiades I* (= *CPF* I** 43.4T).]

122. PORPHYRY Commentary on Ptolemy's *Harmonics* 32.6ff.

Hearing is not like sight, which sends the vision out to the object and receives the apprehension of the object back in exchange ...; rather, as Democritus says, it is a receptacle of words, which awaits the sound like a container. The sound penetrates it and flows in, which is why sight is swifter than hearing. For though lightning and thunder occur simultaneously, we see the former as it happens, but do not hear the latter at all or only some time afterwards; the reason for this is simply that our vision meets the light, whereas the thunder arrives at our hearing, which receives it.

123. a. AULUS GELLIUS *Attic Nights* V.15.8

Democritus and subsequently Epicurus say that sound consists of indivisible corpuscles and, to use their own words, call it a stream of atoms.

b. SEXTUS *Against the Mathematicians* VI.53

Democritus, Plato, and their followers, in doing away with every sensible object [cf. **169, 171**], also do away with sound, which seems to be something sensible.

[Cf. SCHOLIAST on DIONYSIUS OF THRACE 482.13.]

124. Ps-PLUTARCH *Epitome* IV.19.3 [= AETIUS IV.19.3]

Democritus says that the air is split up into corpuscles of the same shape as the fragments of sound, and that they move about together, as 'Birds of a feather flock together' and 'God always puts like with like.' And indeed on a beach pebbles of similar shape are seen in the same place, round in one place and oblong in another. And when people are sieving, things of the same shape settle together, so that the beans are separate from the chick-peas. [Cf. **D6**.] Someone might object, how can a few fragments of breath fill a theatre of ten thousand people?

125. THEOPHRASTUS *On the Causes of Plants* VI.1.2;1.6–2.4

(1.2) The first question is whether one should ascribe them [i.e., flavours] to states of the senses, or, as Democritus does, to the shapes of which they are composed; even if they are not somehow connected with the sense-faculties, still they are posited for the sake of them.

(1.6) Democritus assigns a shape to each [sc. flavour]: he makes sweet round and of a good size; sour large, rough and polygonal, but not round; sharp-tasting, as the name implies, sharp, pointed, bent and fine, but not round; pungent small, round, pointed and bent; salty pointed, of a good size, crooked and isosceles; bitter round and smooth, with crookedness and small size; oily fine, round and small. Those are the different kinds.

(2.1) These [sc. shapes] would perhaps appear, as said above, to be posited for the sake of those [sc. flavours]; he thinks that by this account he can explain their effects, why one contracts, dries and congeals, another smooths, settles and makes regular, another separates and permeates, and so on. Except that perhaps someone might also ask those theorists to say what the subject is like. For one has to know not only what is active, but also what is acted on, especially if the same flavour does not appear alike to everyone, as he says; for there is nothing to stop what is sweet to us from being bitter to some other animals, and similarly for the rest. (2.2) For it is clear that there is a different constitution of the sense-organ; for the shape underlying the flavour is the same, and it seems that that cannot always have the same effect on a different subject. And if that is true, it is clear that one must take into account the dissimilarity of subjects. So one should discuss them. At the same time this too is clear, that the same shape does not have a single effect, if it can act in opposite ways on different subjects. That not everything should be subject to the effect of it is not so absurd, (2.3) for instance fire does not burn everything; but if some things are affected in opposite ways, that needs further discussion. Yet one has to state some cause of those cases; in the case of those things which fire cannot burn or water moisten, there is some cause and explanation; and if they did the opposite, one would need yet more. Those theorists ought to deal with all these topics, but for someone discussing the faculties the only thing necessary is to say what each of the sense-organs is like. One has to know their nature and constitution, for not every part is capable of perception. And perhaps even when one thing comes into being from several, one should not ignore the nature and effect of each. It was absurd on the part of those who posit the atomic shapes to make difference of size between things of the same shape lead to a difference in effect. (2.4) For then the effects depend not on the shapes but on the sizes, which perhaps one might allow to make a difference in the violence and in general the degree of effect, but it is not

reasonable that they should not have the same action or effect at all, if the effects reside in the shapes. For if they are shaped alike, they should have the same properties, as in other cases. For a triangle with sides a foot long and one with sides ten thousand feet long are alike equal to two right angles, and squares to four right angles. These instances differ quantitatively, but their essential properties, e.g., the incommensurability of the side and the diagonal, are the same; so what results from or depends on them ought to have differed quantitatively, but not in kind.

126. THEOPHRASTUS *On the Causes of Plants* VI.7.2

One might ask Democritus how they [sc. the flavours] come from one another. For either the atomic shapes must be reformed, and become round instead of uneven and sharply pointed, or all flavours, e.g., sour, acid, and sweet, are originally present and some get separated out while the rest remain, or thirdly some disappear and some are added. And since it is impossible that they should be reshaped (for the atom cannot be acted on), the remaining possibilities are that some disappear and some are added, or that some remain while others disappear. And both are unreasonable; for one must in addition give some account of what it is that brings this about and does it.

127. a. ARISTOTLE *On Sense* 441a3–20

The nature of water is such as to be tasteless; but the water must either contain within itself all the sorts of flavours, imperceptible through their small quantities, as Empedocles held, or be a material consisting in a sort of generative compound of flavours, so that they all come into being from the water, but different flavours from different parts. ... And similarly it is impossible that the water should be the material of the generative compound; for we see different flavours nourished by the same water.

b. ALEXANDER Commentary on the above 68.24–5

Here he is referring to the opinion of Democritus and his followers, who posited the atoms as principles of everything.

128. THEOPHRASTUS *On Smells* 64

Why does Democritus explain flavours by reference to the sense of taste, but not smells and colours by a like reference to the underlying senses? He ought to, given the atomic theory.

129. THEOPHRASTUS *On the Causes of Plants* VI.17.11

As we have said previously, it is absurd if what is odourless or foul-smelling to us is sweet-smelling to them [i.e., other animals]. But

perhaps it is not absurd; at any rate we see this happening in other cases, e.g., the simple case of their food, for which the cause is most obviously their different constitutions. For since Democritus' atoms have the forms [sc. of the animals] assigned to them, they ought to have their attributes assigned too.

130. SIMPLICIUS Commentary on *De Caelo* 564.24–9

Democritus, considering, as Theophrastus relates in his *Physics*, that the explanations offered of heat, cold etc. were amateurish, had recourse to the atoms, as the Pythagoreans did to planes. They believed that heat and cold are the effects of shapes and sizes, those which divide and separate causing a sensation of heat, and those which gather together and condense a sensation of cold.

Thought

131. a. CICERO *Ad Familiares* XV.16.1

Somehow when I write anything to you it seems almost as if you were with me, and not just 'in imaginative representations,' in the words of your new friends who think that their 'intellectual representations' are stirred up by Catius' spectres – for, don't forget, the Epicurean Catius from Insubria, who died recently, called 'spectres' what the master from Gargettus [i.e., Epicurus] and Democritus before him called *eidōla* – now though the eyes can be struck by these spectres, which meet you willy-nilly, I don't see how the mind can be. You must explain it to me when you come safe home, so that I can have your spectre in my power, so that it presents itself as soon as I want to think of you, and not only of you, whom I have in my heart, but if I begin to think of the island of Britain, its *eidōlon* will come flying into my chest.

b. CICERO *De Natura Deorum* I.38.105–10

You [i.e., the spokesman of the Epicureans] said that the representation of a god is grasped by thought, not by sense, that it does not have any solidity or remain numerically the same, but our impression of it arises from a succession of similar images constantly produced by the infinite number of atoms, and it is by attending to that that we think the divine nature to be blessed and eternal. Now by the very gods we are talking about, what kind of thing is this? For if they are real only in relation to our thought and have neither solidity nor three dimensions, what is the difference between thinking of a hippocentaur and thinking of a god? Other philosophers call every such mental content an empty fantasy, but you say it is the occurrence and impact of images on our minds. So when I seem

to see Tiberius Gracchus speaking in the Capitol and proposing his motion about Marcus Octavius I call this a fantasy of the mind, but you say that the images of Gracchus and Octavius have remained there, so that when I come to the Capitol they are brought into contact with my mind. And the same thing happens in the case of a god ...

Now what are these images of yours, and where do they come from? This extravagance is taken wholly from Democritus. But he himself was subject to a great deal of criticism, and you can find no escape either; the whole thing is weak and lame. For what is less plausible than that images of Homer, Archilochus, Romulus, Numa, Pythagoras, and Plato should impinge on me at all, much less in the form which they actually had? For how do those images arise, and what are they images of? Aristotle says that the poet Orpheus never existed, and the Pythagoreans say that the supposed Orphic poem was written by a certain Cercops; but Orpheus, that is to say the image of him, as you will have it, often occurs to my mind. What of the fact that different images of the same man occur to my mind and to yours? Or that there are images of things that never existed at all or could have existed, like Scylla and the Chimaera? Or that we have images of men, places, and cities that we have never seen? Or that as soon as I choose to think of something an image immediately occurs to me? Or that even when one is asleep they come uninvited? The whole thing, Velleius, is nonsense. Now you thrust images not only into our eyes but even into our minds; such is the licence of your chatter. But how extravagantly! There is a constant succession of fleeting impressions, to produce a single appearance. I should be ashamed to say that I did not understand, if you, the defenders of this doctrine, understood it yourselves. For how do you show that images are continuously thrown off, or if continuously how are they eternal? There is an innumerable supply of atoms, you say. But surely that will make everything eternal. You appeal to the principle of equilibrium (let us use that term for *isonomia*,[119] if you agree), and say that since there is a mortal nature there must be an immortal one. By this argument since there are mortal men there are some who are immortal, and since they are born on earth they are born in water. 'And because there are forces which destroy, there are forces which preserve.' Let it be so; still they preserve what exists, and I am not aware that those gods of yours do exist. In any case, how are all these representations of things produced from indivisible corpuscles? Even if there were such things, which there are not, they could perhaps knock and jostle each other in their collisions, but they could not give anything

119 See Mugler 39.

form, shape, colour or life. So there is no way in which you show god to be immortal.

[Cf. AUGUSTINE on the above *Letter* CXVIII.30. Also cf. **172d**.]

Dreams

132. a. Ps-PLUTARCH *Epitome* V.2.1 [= AETIUS V.2.1]

Democritus says that dreams occur through the presence of *eidōla*.

b. CICERO *De Divinatione* II.58.120

Should we say that the minds of those who are asleep are internally stimulated, or, as Democritus says, disturbed by sights coming from outside?

c. CICERO *De Divinatione* II.67.137

What Marius do you think it was that I saw? 'An appearance of him, I think, and an image, as Democritus believes.' Now where does that image come from? For he thinks that 'images' flow off material bodies and actual forms.

d. ARISTOTLE *On Divination in Sleep* 464a5–17

The following would be a better explanation [sc. of dreams of certain specific kinds] than that given by Democritus, who cites *eidōla* and effluences as the cause. Just as when something sets water or air in motion, that moves something else, and after the original cause has ceased that motion continues for a time, though the origin of the motion is not present, similarly there is nothing to prevent a certain motion and sensation reaching the souls of people who dream, starting from the things from which he produces his *eidōla* and effluences. They are more readily perceptible at night because those which are transmitted during the day tend to be dispersed (there is less disturbance at night because the air is stiller), and they cause perception in the body at night because when people are asleep they are more aware of minute internal motions than when they are awake.

133. a. PLUTARCH *Convivial Questions* VIII.10.2, 734f–735c

Favorinus found an old theory of Democritus,' all black with smoke, and cleaned and polished it, taking as his starting-point this familiar saying of Democritus' 'The *eidōla* penetrate bodies through their pores and when they come up again[120] cause people to see things in their sleep; they come

120 This term indicates that the *eidōla* penetrate the soul-body complex through its pores and then rebound from the interior to the surface of some part of that complex, at which point they are experienced in sleep. It is unclear what surface is intended; some scholars (e.g., Cambiano 63) have suggested that of the brain, but there is no independent

from things of every kind, artefacts, clothes, plants, but especially from animals, because of the quantity of motion [sc. of the atoms] and heat they contain. They do not merely reproduce the shape of the body' (which is the view of Epicurus, who follows Democritus so far but departs from his theory subsequently) 'but they also pick up images of each person's psychic motions, desires, habits, and emotions, and when, together with these images, they collide with people they talk as if they were alive, and tell those who receive them the opinions, words and actions of those who emitted them, provided that they preserve the images articulated and distinct on arrival.' They do this most when they have a swift, unobstructed passage through smooth air. But in autumn the trees shed their leaves into the air, making it very rough and uneven, which distorts and deflects the *eidōla* in all sorts of ways and weakens and obscures their clarity by slowing down their flight, just as on the other hand an abundant flow arriving quickly from things swollen to bursting produces clear and significant images.

b. PLUTARCH *Convivial Questions* V.7.6, 682f–683b

Are the *eidōla* of Democritus ... left entirely out of account? He says that malevolent people emit them, so that they fly about and do not totally escape perception, full of the wickedness and malignancy of their source, and as they get imprinted on people and fixed with that character, they disturb the body and mind of those who are subject to malign influence. That is what I think the man means, but his language is lofty and marvellous. [Cf. **211a–c**.]

134. a. Ps-PLUTARCH *Epitome* V.25.3 [= AETIUS V.25.3]

Leucippus says that sleep is something bodily, which occurs when the excretion of fine-textured atoms exceeds the accretion of psychic warmth; excess of this causes death. These are things which happen to the body, not the soul.

b. TERTULLIAN *De Anima* 43.2

Democritus says that it [i.e., sleep] is a deficiency of the mind.

BIOLOGY AND OTHER NATURAL SCIENCES

[The sources attest atomistic observations and explanations of a wide variety of biological and other phenomena. For reasons of space, a selection only is translated.]

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evidence that Democritus gave the brain any special role in thought, perception, or any related mental activity.

135. Ps-PLUTARCH *Epitome* V.3.6 [= AETIUS V.3.6]

Democritus says that it [i.e., semen] comes from the whole body and the most important parts, e.g., bones, flesh, and sinews.

[Cf. **D8–9**.]

[Cf. V.4.1 and 3; V.5.1.]

136. a. ARISTOTLE *GA* 740a33–b1

The veins join on to the uterus like roots, through which the embryo receives nourishment. That is why the animal remains in the uterus, not, as Democritus says, in order that its parts should be moulded by the parts of the mother.

b. ARISTOTLE *GA* 746a19–28

Those who say that children in the womb feed by sucking some little fleshy part are wrong. ... Thus those, for example Democritus, who put forward this view are mistaken.

[Cf. AETIUS V.16.1; GALEN (?) Commentary on Hippocrates *On Food* (= *CPF* 1*9 1T, 149–51)]

c. PLUTARCH *On Love of Offspring* 3, 495e

The navel is formed first in the womb, as Democritus says, as an anchor to stop the foetus from rolling and shifting about. It acts as a cable and as a shoot for the offspring which is coming into being.

[Cf. PLUTARCH *The Fortune of the Romans* 2, 317a.]

137. a. ARISTOTLE *GA* 730a13–14

Those, like Democritus, who say that the external parts of animals are formed first, and then the internal, are wrong.

b. CENSORINUS *De Die Natali* 6.1

[On which parts of the body are formed first] Democritus says that it is the belly and head, which contain the most void.

138. a. ARISTOTLE *GA* 764a6–b20

Democritus of Abdera says that the differentiation of male and female occurs in the mother, but it is not because of heat and cold that some become male and some female, but because of the predominance of the semen of one or other parent, coming from the parts in which the male and female differ.[121] ... Thus the theory of Democritus would be better [sc. than that of Empedocles, who explains the difference by difference of temperature in

121 See de Ley 73.

the uterus], at least as far as this goes, for he seeks for the difference in this development and tries to set it forth. Whether he does so well or not is another question. ...

If the facts about semen are as we have actually stated, and it does not come from the whole of the body of the male parent and the secretion of the male does not give any material to the embryo, then we must take a stand against Democritus and Empedocles and anyone else who argues on the same lines. For it is not possible ... that the whole is drawn off from each parent and the combination of the two becomes male or female according as one part prevails over the other.

b. ARISTOTLE *GA* 769a17–22

Those who assign the same cause of sex as Empedocles or Democritus say what is on other grounds impossible, and those who say that it is determined by the greater or smaller amount of semen coming from the male or female parent, and that is why one child is male and another female, cannot show how the female is to resemble the father and the male the mother, for it is impossible that more should come from both at once.

[Cf. Ps-PHILOPONUS On *GA* 167.13–19.]

c. CENSORINUS *De Die Natali* 6.5

Democritus maintained that, whichever parent's seed first occupied the position, that parent's nature was reproduced.

d. Ps-PLUTARCH *Epitome* V.7.6 [= AETIUS V.7.6]

Leucippus says [that the differentiation of the sexes occurs] through the difference of parts, in which one has a penis, the other a womb; that is all he says.

Democritus says that the parts which are common [sc. to both sexes] come from either parent, but those which differentiate [sc. the sexes] according to the predominant sex [sc. of the parents].

[Contrast NEMESIUS *On the Nature of Man* 247

Aristotle and Democritus think that the semen of the woman contributes nothing to the generation of children.]

139. ARISTOTLE *PA* 640b30–5

Do, then, configuration and colour constitute the essence of the various animals and of their several parts? For if so, what Democritus says will be correct. For such appears to have been his notion. At any rate he says that it is evident to everyone what form it is that makes the man, seeing that he is recognizable by his shape and colour.

[Cf. **D5**.]

140. ARISTOTLE *GA* 769b30–6

Democritus said that monsters are produced by the confluence of two successive discharges of semen. The later one is also emitted and flows into the uterus, so that the parts are fused and interlocked. And since in birds copulation occurs quickly, he says that eggs and their colours always get interlocked.

141. ARISTOTLE *GA* 788b10–28, 789b2–8

Democritus has spoken of these questions [sc. on the growth and shedding of teeth] but not well, for he assigns the cause too generally without investigating the facts in all cases. He says that the early teeth are shed because they are formed in animals too early, for it is when animals are practically in their prime that they grow naturally, and he says that sucking is the cause of their being formed too early. Yet the pig also sucks but does not shed its teeth, and, further, all the saw-toothed animals suck but some of them do not shed any teeth except the canines, e.g., lions. This mistake, then, was due to his speaking generally without examining what happens in all cases; but this is what we ought to do, for anyone who makes any general statement must speak of all the particular cases.

Now we assume, basing our assumption on what we see, that nature never fails or does anything in vain so far as possible in each case. And it is necessary, if an animal is to obtain food after the time of taking milk is over, that it should have instruments for the treatment of the food. If, then, as Democritus says, this happened about the time of reaching maturity, nature would fail in something possible for her to do. And, besides, the operation of nature would be contrary to nature; for what is done by violence is contrary to nature, and it is by violence that he says the formation of the first teeth is brought about. ...

Democritus, however, neglects the final cause, reducing all the operations of nature to necessity [= **74a**]. Now they are necessary, it is true, yet they are for a final cause and for the sake of what is best in each case. Thus nothing prevents the teeth from being formed and shed in this way; but it is not on account of these causes but on account of the end. These are causes in the sense of being the moving and efficient instruments and the material.

142. ARISTOTLE *PA* 665a30–3

None of the bloodless animals has any viscera. Democritus seems incorrect in thinking that those parts of the bloodless animals are too small to be seen.

143. ARISTOTLE *GA* 747a25–34

The reason [for the sterility of mules] has not been correctly given by Empedocles and Democritus, of whom the former expresses himself obscurely, the latter more intelligibly. For they offer a single account applying to all cases of mating between animals of different kinds. Democritus says that the genital passages of mules are spoiled in the uterus because the animals do not originate from parents of the same kind. But we find that though this is so with other animals they are none the less able to procreate; yet, if this were the reason for their sterility, all others that mate in this way ought to be sterile.

144. Ps-ARISTOTLE *History of Animals* 623a30–3

Spiders can spin their web as soon as they are born, not from within as an excretion, as Democritus says, but from outside, like bark or those creatures that shoot their spines, such as porcupines.

145. From AELIAN *Nature of Animals* XII.16–20

(16) Democritus says that the pig and the dog have large litters, adding the explanation that they have several wombs and places to receive the semen. The seed does not fill all these at a single discharge, but these animals copulate two or three times, so that the continuity can fill up the places which receive the sperm. He also says that mules do not breed, for their wombs are not like those of other animals, but of a different form, hardly capable of containing offspring. For the mule is not a product of nature, but a crafty contrivance of human ingenuity and, one might almost say, of sexual violence. It seems to me, he says, that a mare once happened to give birth after having been raped by an ass, and men, getting the idea from this violent act, went on to develop this kind of breeding. And especially in Libya the asses, which are very large, mount mares which do not have their manes, but have been shorn; for a mare which was glorying in her mane would not endure such a match, the experts in breeding them say. ...

(18) He says that the cause of the growth of antlers in deer is as follows. He acknowledges that their belly is extremely warm, the veins throughout the whole body extremely loose-textured, and the bone containing the brain extremely fine and loose-textured like a membrane, with very broad veins going up to the top of the head. So the nourishment, particularly the most generative element, flows up very quickly and, as he says, the fat spills out, and the force of the nourishment rushes up to the head through the veins. There the horns grow outwards, as they are watered with a great deal of moisture whose continuous flow pushes the previous deposit out. The damp material projecting outside the body is dried and hardened by the air and

becomes horny, while the stuff which is still shut up inside remains soft; the former is hardened by the cold outside, the latter stays soft because of the heat inside. And the growth of new horn pushes the older growth out like something alien, as the inner material chafes and tries to thrust the other out, throbbing in pain in its eagerness to come to birth and come out. For an upsurge of solidified moisture cannot be at rest; it itself hardens and is pushed out on to the earlier ones. Most of these growths are squeezed out by the force of the moisture inside, but some get caught in branches, preventing the animal from moving quickly, and so are broken off by the force of its charge; some drop off, and nature brings out those which are ready to appear ...

(20) In the case of hornless bulls the forehead is not 'honeycombed' as Democritus calls it, meaning 'porous,' but solid bone throughout, with no room for humours to flow in, and so it is bare of any defences. ... To sum up, it is the flow of humours which causes the growth of horns; this is channelled by large numbers of extremely broad veins, which are capable of containing the moisture they are full of.

146. THEOPHRASTUS fr. 171.12

[Fish found on land]

147. SCHOLIAST on HOMER *Iliad* XI.554; AELIAN *Nature of Animals* V.39

[The lion is born with its eyes open.]

148. ETYMOLOGICUM GENUINUM s.v. γλαύξ [= owl]

The owl ... is the creature with the sharpest sight, which can see in the dark. Democritus tells that alone of the taloned flesh-eaters its young are not born blind, because it has a great deal of fiery warmth about its eyes, which is very sharp and cutting and divides and mixes up its sight. So because of the fieriness in its eyes it sees even in the dark of the moon.[122]

149. CICERO *De Divinatione* II.26.57

[Explanation of why cocks crow before dawn]

150. PLUTARCH *Precepts for Health* 14, 129a

[Discusses whether one should try to use the behaviour of animals to forecast the weather.]

[Cf. CLEMENT *Protrepticus* 92.4.]

122 See Burkert 62.

151. GALEN *On the Different Kinds of Pulse* I.25

Democritus somewhere talks about animals which move with an irregular, wavelike motion.

152. SORANUS *Diseases of Women* III.17.105.1

Inflammation [= *phlegmonē*] is so called from the burning [= *phlegein*], not, as Democritus said, from being caused by phlegm [= *phlegma*].

153. PLUTARCH *Convivial Questions* VIII.9, 733d

We know that the Democriteans say and write that, when worlds beyond our own are destroyed and corpuscles of kinds different from ours flow in, sources of plagues and unusual diseases often arise.[123]

154. a. Ps-GALEN *History of Philosophy* 123

Democritus said that animals first come into being through condensation of generative moisture. [Text uncertain]

b. CENSORINUS *De Die Natali* 4.9

Democritus of Abdera thought that human beings were first brought into being from water and mud.

c. LACTANTIUS *Institutiones Divinae* VII.7.9

Democritus was wrong to think that human beings were generated from the earth like worms, without any design or any creator.

155. a. Ps-ARISTOTLE *On Plants* 815b14–16

The view of Plato, then, who held that plants have sensation and desire, was remarkable, but not unsound; but Anaxagoras and Democritus and Empedocles declared that they possessed intellect and intelligence.

b. PLUTARCH *Natural Causes* I, 911e

Plato, Anaxagoras, Democritus, and their followers think that a plant is an animal fixed to the earth.

156. THEOPHRASTUS *Causes of Plants* I.8.2; II.11.7–8

[On the growth of plants]

157. THEOPHRASTUS *On Fire* 52

There is also the problem of why a flame is shaped like a pyramid. Democritus says that as its extremities cool down it contracts into a small space and eventually tapers to a point.

123 See Mugler 67.

158. ARISTOTLE *De Caelo* 313a21–b5

Democritus' opinion on the cause of all these things [the fact that metal plates float on water, whereas lighter objects of a different shape sink, etc.] is not correct. He says that, among objects which have weight, the broad ones are borne up by the hot [atoms] travelling up from the water, while the narrow ones slip through, as only a few [atoms] collide with them. But they ought to do so even more in air, as he himself objects. But having put the objection, he makes a weak reply, saying that the 'rush' does not arrive at a single place (he uses the term 'rush' for the upward motion of the bodies).

159. ALEXANDER *On Mixture and Growth* 2

Democritus thinks that what is called blending comes about by the juxtaposition of corpuscles, as the things which are blended are divided up into small fragments whose positioning beside one another constitutes the mixture. In reality, he says, nothing is really blended, but what appears to be a blend is the juxtaposition of tiny corpuscles each of which retains the nature which it had before the mixture. They appear to be blended because none of the juxtaposed items is big enough to be perceived individually.
[Cf. AETIUS I.17.2; PHILOPONUS Commentary on *GC* 192.29–193.4.]

160. ALEXANDER *Questions and Answers* II.23

Democritus posits that effluences are emitted and that like is drawn to like, and also that everything travels into the void. On these assumptions he supposes that the loadstone and the iron are composed of similar atoms, but smaller in the case of the stone, which is also looser-textured than the iron with more void. Therefore its atoms are more mobile, and they move quickly towards the iron (moving towards their like), enter its pores, and as they penetrate it move its atoms through their small size. The atoms which are set in motion flow outwards towards the stone because of its likeness and because it has more void, and the iron itself follows and moves towards the stone on account of the heavy discharge of atoms. It is no longer the case that the stone travels towards the iron because the iron does not have so much void as the stone. Now one might accept that loadstone and iron are composed of similar elements, but how could amber and chaff be? And if someone says that here too this is the cause, many things are attracted by amber. Now if all of these are composed of similar elements [sc. to those of amber], they would be composed of similar elements to one another, and would attract one another.

161. ALBERT THE GREAT *On Stones* I.1.4

Democritus and others say that the elements have souls and are themselves the causes of stones' coming into being; consequently he says that there is a soul in a stone just as in any other generative seed, which in bringing a stone into being moves the heat within the material itself in the way in which the hammer is moved by the smith in making an axe or a saw.

162. SENECA *Natural Questions* IVB.9–10

The theory of Democritus belongs to this type. The more solid a body is, the quicker it absorbs heat and the longer it retains it. So if you put a bronze vessel and a glass one in the sun, the bronze will become hot more quickly and stay hot longer. He adds why he thinks this happens. In those bodies, he says, which are harder and denser the pores must be smaller and the air in each of them thinner; it follows that, just as smaller bathtubs and containers heat up more quickly, so here these hidden pores, which are too small to see, both feel the heat more quickly and, being narrow, are slower to lose the heat they have received. This long preamble leads to the matter under consideration. [Viz. the air closer to the surface of the earth, being denser than the upper atmosphere, is hotter.]

163. VITRUVIUS VII, preface 11

Instructed by him [i.e., Agatharchus, a contemporary of Aeschylus], Democritus and Anaxagoras wrote on the same topic [i.e., painting of stage scenery in perspective].

[We have a small amount of other evidence of Democritus' scientific and technical writings. VARRO includes his name in a list (*De Re Rustica* I.1.8) of ancient writers on agriculture [cf. **40** (48) XIII.1]. Various agricultural precepts are recorded by COLUMELLA in the following passages: I.1.7, III.12.5, VI.28.1, VIII.8.7, IX.14.6, XI.3.2 (see Freeman 1948 (bibliography, item 1) nos. 27–8 (p. 98)). SENECA (*Letters* 90.32: DK 68 B300.14) reports a statement of Posidonius to the effect that Democritus invented the arch, and adds the (clearly legendary) statements that Democritus discovered processes of softening ivory and turning pebbles into emeralds. A textually corrupt passage of VITRUVIUS (IX, preface 14: DK 68 B300.2) may refer to a treatise on gem-cutting, but the sense is obscure. In both of the last two passages there may be a confusion with the magical treatise of Bolus of Mende (third century BC), which passed under the name of Democritus (see DK 68 B300).

The latter may well be the source of the numerous items of natural lore, many of them magical in character, ascribed to Democritus by Pliny the Elder in the following passages of his *Natural History*: VIII.61; XI.80; XIII.131; XIV.20; XV.138;

XVII.23, 62; XVIII.47, 159, 321; XX.19, 28, 149; XXI.62; XXIV.156, 160, 162–3; XXV.13–14, 23; XXVI.19; XXVII.141; XXVIII.7, 117–18, 153; XXIX.72; XXX.8–10; XXXII.49; XXXVII.69, 146, 149, 160, 185 (see DK 68 B300.8). A few examples will show the character of this material.

XXIV.163 Democritus says that the *thērionarca* [a plant, literally 'animal-drugger'], which grows in Cappadocia and Mysia, makes all wild animals become torpid, and that they cannot be revived unless sprinkled with the urine of a hyaena.

XXXII.49 Democritus tells us that if the tongue, with no other part of the body adhering to it, is taken from a live frog and, after the frog has been released into water, is placed on the beating heart of a sleeping woman, she will give true answers to every question.

XXXVII.146 Aspisatis [a kind of stone], according to Democritus, occurs in Arabia and is of a fiery colour. He recommends that sufferers from an enlarged spleen should wear it as a amulet with camel dung.

Those who regard Democritus as a serious thinker will approve the verdict of AULUS GELLIUS (*Attic Nights* X.12.6 and 8: DK 68 B300.7):

'I think that these spurious wonders related by Pliny are not worthy of the name of Democritus. ... Many fictions of this kind seem to me to have been foisted on Democritus by ignorant men, sheltering under his reputation and authority.']

MATHEMATICS

164. PLUTARCH *On Common Notions* 39, 1079e

See how he [i.e., Chrysippus] answered the following ingenious scientific problem posed by Democritus. If a cone were cut in a plane parallel to the base, what should we think about the surfaces of the segments; are they equal or unequal? If they are unequal they will make the cone uneven, with many step-like indentations and projections; but if they are equal the segments will be equal and the cone will turn out to have acquired the character of the cylinder, being made up of equal and not unequal circles, which is most absurd.[124]

165. ARCHIMEDES *Mathematical Theorems addressed to Eratosthenes* (*Works*, ed. Heiberg, 2.430)

Eudoxus first discovered the proof that the cone is one-third of the cylinder of equal height on the same base, and the pyramid one-third of the prism. No small share [of this discovery] should be assigned to Democritus, who first made the assertion about the above-mentioned figure without proof.

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124 See Heath 75, vol. 1, pp. 176–81, Mau 76, Vlastos 78, Hahm 74, Seide 77, White 79, pp. 208–9, 293–306.

LITERARY CRITICISM AND THEORY OF LANGUAGE

166. a. CICERO *De Oratore* II.46.194

I have often heard it said that no one can be a good poet without mental inspiration and the inbreathing of a kind of madness; it is said that this is asserted by Democritus and Plato in their writings.

b. CICERO *De Divinatione* I.38.80

Democritus denies that anyone can be a great poet without madness, and Plato says the same.

c. CLEMENT *Miscellanies* VI.168

Similarly Democritus says 'What a poet writes with inspiration and the breath of the gods is very fine' [= **D12**].

d. DIO CHRYSOSTOM 36.1

Democritus says this about Homer: 'Homer, by getting a share in the divine nature, accomplished the ordering of all kinds of verses' [= **D13**], meaning that he could not have composed such fine and learned poems without a divine and superhuman nature.

[Cf. HORACE *De Arte Poetica* 295–7.]

[A few scraps of Democritus' elucidations of Homer [cf. **40** (48) XI.1] are preserved by later commentators. These are not translated. See Freeman 1948 (see bibliography item 1) p. 97, nos. 22–5.]

167. PROCLUS Commentary on Plato's *Cratylus* 16, pp. 5.25–7, 6.20–7.6 Pasquali

Pythagoras and Epicurus took the view of Cratylus [viz. that names belong to things by nature], Democritus and Aristotle that of Hermogenes [viz. that names belong to things by convention]. ... Democritus supported his view that names belong to things by convention by four arguments. First, that from homonymy: different things are called by the same name, so the name does not belong to them by nature. Then, that from polyonymy: if different names fit one and the same thing, they must fit one another, which is impossible. Third, that from change of names: why was Aristocles' name changed to Plato, and Tyrtamus' to Theophrastus, if names apply by nature? Then, that from absence of similar terms: why do we form the verb 'think' from 'thought,' but do not form any verb from 'justice'? Names, therefore, apply by chance, not by nature. He himself calls the first argument 'the ambiguous,' the second 'the equivalent' <the third 'the name-changing'> and the fourth 'the anonymous.'[125]

125 See Philippson 80, Denyer 81, pp. 68–9.

168. OLYMPIODORUS Commentary on Plato's *Philebus* p. 242 Stallbaum

Why has Socrates so much reverence for the names of the gods? [See *Phil.* 12c.] ... Is it that these too are images of the gods that speak to us, as Democritus says?

[Cf. **175b**, **211**.]

169. MALLIUS THEODORUS *On Metre* VI.589.20 Keil

Democritus says that the dactylic hexameter was invented by Musaeus.

170. ETYMOLOGICUM of ORION 153.5

[Supposed etymology of name Tritogeneia [cf. **40** (46) I.4], wrongly supposed to be derived from *tritos* = third]

Athena Tritogeneia [i.e., 'thrice-born' or 'third-born'] according to Democritus is identical with intelligence; for from intelligence there are born these three things, to deliberate soundly, to speak without error, and to do what one should.

[Cf. SCHOLIAST on *Iliad* VII.39.]

[Various ancient grammarians and lexicographers record particular words or phrases and dialect forms as having been used by Democritus. These are not translated. See Freeman 1948 (see bibliography item 1) nos. 19–20 (p. 97), 29–29a (p. 98), 120–3[126] (p. 104), 128–41 (pp. 104–5), 144a (p. 105), 150–151 (p. 105), 162 (p. 106), 298 (p. 118).]

THEOLOGY

171. a. STOBAEUS I.1.29b [= AETIUS I.7.16]

Democritus says that god is mind in spherical fire.

[The version of St Cyril adds 'and it is the soul of the world.' See Diels *Dox.* 302. Cf. EUSEBIUS *Praeparatio Evangelica* XIV.16.6.]

b. TERTULLIAN *Ad Nationes* II.2.18

Democritus conjectures that the gods came into being with the rest of the fire in the heavens.

172. a. CICERO *De Natura Deorum* I.12.29

What about Democritus? Does he not go completely astray in counting among the gods images and their wanderings, as well as that nature which grounds and emits the images and our thought and intelligence? Since he

126 123, from the *Etymologicum Genuinum*, a lexicon of the ninth–tenth centuries AD, records the use of the word *deikelon* as a technical term equivalent to *eidōlon*, defined as 'an effluence similar to the things in form.'

denies that anything at all is eternal, on the ground that nothing remains in the same state for ever, surely he eliminates the divine so completely as to leave no room for any belief in it.

b. CICERO *De Natura Deorum* II.30.76

So, first, one must either deny that there are any gods, as Democritus does in a way by introducing his simulacra and Epicurus by introducing his images ...

c. CICERO *De Natura Deorum* I.43.120

In my opinion even Democritus, a man of the first rank from whose springs Epicurus watered his garden, vacillates about the nature of the gods. For he says that the universe contains images endowed with divinity, and also that the gods are the basic principles of mind in that universe, that they are living images which are beneficial or harmful to us, and again that they are images of such an enormous size as to enfold the entire world. All of this is worthier of Democritus' native city than of Democritus.

d. AUGUSTINE *Letter* CXVIII.27–8

How much better had I never heard the name of Democritus than to recall to my sorrow that someone who was accounted a great man in his day believed that the gods are images flowing off from solid bodies but not themselves solid, going about hither and thither with their own motion, slipping into the minds of men and giving rise to the idea of divine force, when in fact that body from which the image flows must be judged more substantial, to the extent that it is more solid.

Democritus, however, is said to differ from Epicurus on natural questions in this respect among others, that he felt that that there is in the conglomeration of atoms a certain vital, animal force. It is because of this, I believe, that he said that the images themselves are 'endowed with divinity' (not images of everything but images of the gods), that there are 'basic principles of mind in the universe' to which he attributed divinity, and 'living images which are beneficial or harmful to us.' Epicurus, on the other hand, posits among the principles of things nothing except the atoms, i.e., corpuscles so minute as to be incapable of division, or of being felt, seen or touched. It is by the chance combination of these corpuscles, he says, that there are formed innumerable worlds and living things and even souls and the gods, whom he placed in human form not in any particular world but outside and between the worlds. He does not allow that one can think of anything at all except bodies; and to account for our thinking he says that images flow off from the things composed of atoms and enter our minds; these are of a finer texture even than visual images (for that is what causes sight as well). 'They are images of such an enormous size as to as to enfold the entire world.' Now, I think, you understand what they think about images.

e. LACTANTIUS *On the Wrath of God* 10.28–9

Let us however grant them that things on earth are composed of atoms. Is this the case with things in heaven too? They say that the gods are imperishable, eternal, and blessed, and to them alone they grant immunity from appearing to be composed of atoms. For if the gods too were composed of them, they would be dissipated when their components were dissolved back into their own nature.

[Cf. **211.**]

173. a. SEXTUS *Against the Mathematicians* IX.24

Some people think that we arrived at the idea of gods from the remarkable things that happen in the world. Democritus seems to me to be of that opinion; he says that the people of ancient times were frightened by happenings in the heavens such as thunder, lightning, thunderbolts, conjunctions of stars, and eclipses of the sun and moon, and thought that they were caused by gods.

[Cf. **214**; LUCRETIUS V.1186–93.]

b. SEXTUS *Against the Mathematicians* IX.42

Democritus is not to be believed, since he explains what is less problematic by what is more problematic. For nature gives a great many different indications of how human beings got the idea of gods; but that there should be in the environment gigantic images in human shape and generally all the sorts of things that Democritus tries to imagine is altogether unacceptable.

174. PLINY *Natural History* II.5.14

To believe in innumerable gods, and to model them on human failings, for instance Modesty, Concord, Mind, Hope, Honour, Clemency, Honesty, or, as Democritus did, to believe in just two, Punishment and Reward, is to reach a greater height of folly [sc. than to attribute human form to the gods].

175. a. PLUTARCH *On the Cessation of Oracles* 17.419a

Democritus, by praying to encounter 'propitious *eidōla*,'[127] clearly recognized that there are others which are ill disposed, with wicked intentions and impulses.

b. SEXTUS *Against the Mathematicians* IX.19

Democritus says that some *eidōla* encounter people, and of these some are beneficial and some harmful; hence he prayed to find propitious *eidōla*.

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127 The phrase also occurs in PLUTARCH *Life of Timoleon* 235.2.

These are huge and gigantic and difficult to destroy, but not indestructible, and they foretell future events to people by appearing to them and speaking. It was from the appearance of these very things that the ancients came to believe in the existence of gods, though apart from these there is no god possessing an immortal nature.
[Cf. CLEMENT *Miscellanies* V.88; ANON. Hermippus I.16 (an anonymous astrological work, tentatively ascribed by DK to the fourteenth-century writer Ioannes Catrares).]

176. a. CICERO *De Divinatione* I.3.5

In many places the weighty author Democritus expressed belief in precognition of things to come.

b. CICERO *De Divinatione* I.57.131

Now Democritus holds that the people of ancient times were wise to institute the practice of inspecting the entrails of victims, since in their nature and colour may be perceived signs of health or sickness, and sometimes even whether the land will be barren or fertile in the future.
[Cf. II.13.30.]

EPISTEMOLOGY

177. ARISTOTLE *Metaphysics* 1009b7–17

Further, to many of the other animals the same things appear opposite from the way they appear to us, and to each individual things do not always seem the same, as far as the senses are concerned. So which of these is true or false is unclear; for this is no more true than that, but they are alike. This is why Democritus said that either nothing is true, or it is unclear to us.[128] And in general because they suppose that intelligence is sensation, and the latter is alteration, they say that what appears to sense is necessarily true. For it is from those assumptions that Empedocles and Democritus and pretty well all the others are committed to such views.
[Cf. ALEXANDER Commentary 306.3–308.5]

178. a. SEXTUS *Outlines of Pyrrhonism* I.213–14

But the philosophy of Democritus is also said to be akin to scepticism, since he appears to make use of the same material as we do; for from the fact that honey appears sweet to some and bitter to others they say that Democritus concludes that it is neither sweet nor bitter, and therefore pronounces the sceptical formula 'No more' [sc. one thing than another].

128 For the interpretation of this sentence see commentary 'Epistemology,' pp. 221–2.

However, the sceptics and the followers of Democritus use the 'No more' formula differently; they apply it in the sense that the thing is neither [sc. one thing nor another], whereas we apply it in the sense that we are ignorant of whether it is both or neither of the ways it appears. So we differ in that way, and the distinction becomes very clear when Democritus says 'in reality atoms and void.' He uses the phrase 'in reality' for 'in truth'; and when he says that the atoms and the void exist in truth it is, I think, superfluous to point out that he differs from us, even if he takes his starting-point from the inconsistency of the appearances.

b. SEXTUS *Outlines of Pyrrhonism* II.63

From the fact that honey appears bitter to some people and sweet to others Democritus said that it is neither sweet nor bitter.

c. PLUTARCH *Against Colotes* 4, 1108f

The first charge Colotes makes against him [Democritus] is that by saying that each thing is no more of one kind than another he has thrown life into confusion. But Democritus was so far from thinking that each thing is no more of one kind than another that he opposed the sophist Protagoras for saying just that and wrote many persuasive arguments against him. Colotes did not come across these, even in a dream, and was misled by Democritus' phraseology, when he said that thing is no more than nothing, calling 'thing' body and 'nothing' the void,[129] since that too has a nature and substance of its own.[130]

179. a. SEXTUS *Against the Mathematicians* VII.135–40

In some places Democritus does away with the sensory appearances, and says that none of them appear in reality but only in opinion, and that what is real in things is that there are atoms and void. For he says 'By convention sweet and by convention bitter, by convention hot, by convention cold, by convention colour; but in reality atoms and void' [= **D16**]. That is to say, the sensible qualities are conventionally considered and thought to exist, but in reality they do not exist, but only atoms and the void. And in his *Confirmations*, although he had undertaken to give the senses control over belief, he is found to be no less condemnatory of them. For he says 'In fact we know nothing firm, but what changes according to the condition of the body and the things that enter it and come up against it' [= **D17**]. And again, he says 'That in reality we do not know what kind of thing each thing is or is not has been shown many times' [= **D18**]. And in his work on forms he says 'By this principle man must know that he is removed from reality' [=

129 Cf. **44a**, with footnote.

130 See de Lacy 89.

D19] and again 'This argument too shows that in reality we know nothing about anything, but each person's opinion is something which flows in'[131] [= **D20**], and then 'Yet it will be clear that to know what kind of thing each thing is in reality is impossible' [= **D21**].

In these passages he more or less abolishes every kind of apprehension, even if the senses are the only ones which he attacks specifically. But in his *Canons* he says that there are two sorts of knowledge, one through the senses and the other through thought; he calls knowledge through thought 'genuine,' testifying in favour of its trustworthiness in the judgment of truth, and he names knowledge through the senses 'bastard,' denying it inerrant recognition of the truth. His own words are 'There are two forms of knowledge, genuine and bastard. To the bastard form belong all these, sight, hearing, smell, taste, touch, but the genuine is separate from this.' Then he continues, ranking the genuine above the bastard form, 'When the bastard form can no longer see anything smaller or hear or smell or taste or perceive by touch, but to a finer degree ...' [= **D22**]. So by this argument there is a criterion, which he calls genuine knowledge. And Diotimus[132] used to say that according to him there were three criteria, the appearances for the apprehension of things hidden, as Anaxagoras says (Democritus praises him for this), the conception for the investigation (for in all things ... the single starting-point is the knowledge of the object of the investigation), and feelings for choice and avoidance; for what we feel attracted to, as belonging to us, that is to be chosen, and what we feel alienated from, that is to be avoided.

b. DIOGENES LAERTIUS IX.72

Democritus, getting rid of the qualities, where he says 'By convention hot, by convention cold, but in reality atoms and void' and again 'In reality we know nothing, for truth is in the depths' [= **D15**].

c. GALEN *On Medical Experience* 15.7

If someone cannot even make a start except from something evident, how can he be relied on when he attacks his very starting-point? Democritus was aware of this; when he was attacking the appearances with the words 'By convention colour, by convention sweet, by convention bitter, but in reality atoms and void' he made the senses reply to thought as follows: 'Wretched mind, you get your evidence from us, and yet you overthrow us? The overthrow is a fall for you' [= **D23**].

d. GALEN *On the Elements according to Hippocrates* I.2

'For by convention colour, by convention sweet, by convention bitter, but in reality atoms and the void' says Democritus, who thinks that all

131 For the translation see note on **D20**.

132 A follower of Democritus; see DK 76.

the perceptible qualities are brought into being, relative to us who perceive them, by the combination of atoms, but by nature nothing is white or black or yellow or red or bitter or sweet. By the expression 'by convention' he means 'conventionally' and 'relative to us,' not according to the nature of things themselves, which he calls by contrast 'reality,' forming the term from 'real' which means 'true.'[133] The whole substance of this theory is as follows. People think of things as being white and black and sweet and bitter and all the other qualities of that kind, but in truth 'thing' and 'nothing' is all there is. That too is something he himself said, 'thing' being his name for the atoms and 'nothing' for the void.[134] All the atoms are small bodies without qualities, and the void is a space in which all these bodies move up and down for ever, or somehow get entangled with one another or collide or rebound, and in these contacts they separate and combine again, thus making all combinations including our bodies and their states and perceptions. They think that the primary bodies are incapable of being affected (some, such as the followers of Epicurus, taking them to be invulnerable because of their hardness, others, such as the followers of Leucippus, to be indivisible because of their smallness),[135] and incapable of any change in those qualities which all men, taught by their senses, have believed in; thus they say that none of them becomes hot or cold, or dry or wet, much less turns black or white or suffers any qualitative change of any kind.

[Cf. AETIUS IV.9.8; EPIPHANIUS *Against Heresies* III.13.]

180. SEXTUS *Against the Mathematicians* VII.369

Some of the natural scientists, e.g., Democritus and his followers, have done away with all the appearances [sc. as false], others, e.g., Epicurus and his followers and Protagoras, have established them all [sc. as true], while others, e.g., the Stoics and Peripatetics, have done away with some and established others.

181. SEXTUS *Against the Mathematicians* VII.389–90

One could not say that every appearance is true, since this leads to self-refutation, as Democritus and Plato taught in opposition to Protagoras [= **13**]. For if every appearance is true, then that not every appearance is true, which is itself an appearance, will also be true, and so it will become false that every appearance is true.

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133 See commentary 'Secondary Qualities,' pp. 176–7.

134 Cf. **44a**, with footnote.

135 Cf. **50a**.

182. a. SEXTUS *Against the Mathematicians* VIII.6–7

Plato, Democritus, and their followers supposed that only intelligible things are true [or 'real']; in the case of Democritus this was on the ground that there is nothing which is by nature perceptible, since the atoms which compose everything have a nature devoid of all perceptible qualities, but for Plato it was on the ground that perceptible things are always becoming but never in a state of being, since their substance is flowing like a river.

b. SEXTUS *Against the Mathematicians* VIII.56

Democritus, Plato, and their followers, in rejecting the senses, doing away with sensible things and relying exclusively on intelligibles, throw things into confusion, and shake not only the reality of what there is but also their own theories. For every thought comes into being from sensation or not without sensation, and either from experience or not without experience. [Cf. **D23**]

c. SEXTUS *Against the Mathematicians* VIII.184

Democritus says that none of the sensible things exist, but our apprehensions of them are empty states of the senses, and in the external world there is nothing sweet, bitter, hot, cold, white, black, or anything else which appears to everyone, for these are names for our states.

d. SEXTUS *Against the Mathematicians* VIII.355

Democritus overthrew all sensible reality

e. SEXTUS *Outlines of Pyrrhonism* III.33

... Democritus and his followers, who say that they [i.e., the elements] are atomic and devoid of qualities.

f. STOBAEUS I.50.17 [= AETIUS IV.9.1]

Democritus [and others, including the Eleatics and Protagoras] say that the senses are false.

183. a. PHILOPONUS Commentary on *De Anima* 71.19–34

If they [i.e., the early philosophers] said that mind moves everything [Aristotle, *De Anima* 405a18–19], how is it that they said that motion was proper to the soul? Yes, they did, he [i.e., Aristotle] says, for they thought that soul and mind were identical, as for instance Democritus did. Now we nowhere find him explicitly saying that mind and soul are identical, but he establishes this by an argument. Democritus, he says, plainly intends this; for he said straight out that truth and appearance are identical, and that there is no difference between the truth and what appears to the senses, but what appears and seems so to each individual is true, as Protagoras said, whereas in fact they are different, sensation and imagination being concerned with appearance, and the mind with truth. Now if the mind is concerned with truth, and the soul is restricted to appearance, and what is true is the same

as what appears, as Democritus thinks, then the mind is identical with the soul. For as the mind is to truth, so the soul is to appearance; hence, by transposition, as appearance is to truth, so the mind is to the soul. Now if truth and appearance are identical, then the mind and the soul are identical.

b. ALEXANDER Commentary on *Metaphysics* 271.38–272.2

This [i.e., that contradictories are true of the same thing] follows also in the case of those who say that what appears to be and what is are the same, e.g., Democritus, Protagoras, and their followers.

184. a. CICERO *Academica* I.12.44

... Democritus ... and practically all the ancient philosophers, who said that nothing could be recognized, perceived, or known, that the senses are confined, the intellect weak, the space of life short, and, as Democritus says [**D15**] that truth is sunk in the depths, everything is subject to opinion and convention, with no place left for truth, and in a word that everything is shrouded in darkness.

b. CICERO *Academica* II.23.73

But he [i.e., Democritus] does not say what we [i.e., the Academic sceptics] do, who do not deny that there is some truth, but deny that it can be perceived. He flatly denies that there is any truth, and calls the senses not obscure but dark,[136] for that is how he describes them.

[Cf. II.10.32; LACTANTIUS *Institutiones Divinae* III.28.13–14.]

185. SEXTUS *Against the Mathematicians* VIII.327

The dogmatic philosophers and the logical school of doctors affirm it [i.e., demonstration], while the empiricists deny it, and perhaps also Democritus (for he has spoken strongly against in his *Canons* [cf. **40** (47) VI.3]), and the sceptics suspended judgment on it, using their formula 'No more' [cf. **178a**].

186. GALEN *On Medical Experience* 9.5

We find that of the bulk of mankind each individual by making use of his frequent observations gains knowledge not attained by another; for, as Democritus says, experience and vicissitudes have taught men this, and it is from their wealth of experience that men have learned to perform the things they do.

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136 The Latin 'tenebricosus' (from 'tenebrae,' darkness) is clearly a translation of Democritus' *skotios* (**D22**), whose literal sense is 'dark.' The ascription to Democritus of a total denial of any truth (the view of Xeniades, **197**) and the implied understanding of *skotios* as fitting that ascription are transparent misunderstandings.

187. a. PLUTARCH *On the Rationality of Animals* 20, 974a

Perhaps we are ridiculous to make a fuss about animals who can learn, when Democritus shows that in the most important things we have learned from them, spinning and mending from the spider, housebuilding from the swallow, and singing by imitation from songbirds, the swan and the nightingale.

b. PORPHYRY *On Abstention from Animal Food* III.6

... Democritus and all those who were concerned to reach the truth about them [sc. non-human animals] recognized their participation in reason.

ETHICS

188. a. CICERO *De Finibus* V.8.23

Now Democritus' freedom from care, which is a sort of tranquillity of mind which he calls 'cheerfulness,' had to be kept out of this discussion, since that tranquillity of mind is the blessed life itself, and we are discussing, not what it is, but what produces it.

b. CICERO *De Finibus* V.29.87

Democritus who (whether truly or falsely I shall not inquire) is said to have blinded himself [cf. **30–2**], certainly neglected his inheritance and left his fields uncultivated [cf. **21**], so that his mind should be distracted as little as possible from his thoughts; what was his object other than to attain a blessed life? Even if he thought that that lay in consideration of the nature of things, all the same he wanted that investigation of nature to lead to a good state of mind. Therefore he called the supreme good 'cheerfulness' and often 'unastonishment,' i.e., a mind free from fear. But while that is splendid, it is not altogether polished; for he went on to say only a few things about virtue, which did not get to the kernel of things.

c. SENECA *On Tranquillity of Mind* 2.3

This stable state of the mind the Greeks call cheerfulness; there is a splendid book by Democritus about it [cf. **40** (46) II.3]. I call it tranquillity.

d. THEODORETUS *Cure for the Ills of the Greeks* XI.6

Epicurus defined the end as the pleasantest life, since he thought that only pleasure was completely good. Democritus of Abdera, the father of his doctrines, posited cheerfulness instead of pleasure, making a difference of terminology only, not of doctrine.

[Cf. **6** (45).]

189. STOBAEUS II.7.3i [citing ARIUS DIDYMUS]

Democritus and Plato both place blessedness in the soul. The former writes as follows: 'Blessedness and wretchedness belong to the soul' [= **D24**];

'Blessedness does not reside in herds or in gold; the soul is the dwelling-place of the guardian spirit' [= **D25**]. And he calls blessedness cheerfulness and well-being and harmony, as well as proportion and freedom from trouble, and says that it arises from the distinction and discrimination of pleasures, and this is the finest and most beneficial thing for people.

190. CLEMENT *Miscellanies* II.130

The Abderites too teach that there is an end; in his work on the end Democritus says that it is cheerfulness, which he also called well-being. And he often says 'Joy and sorrow are the distinguishing mark' [see **D26**] ... the mature [Text uncertain.][137] ... Nausiphanes says it is freedom from terror; he says that Democritus called that freedom from astonishment.
[Cf. STRABO *Geography* I.61.]

191. CLEMENT *Miscellanies* II.138

Democritus advised against marriage and having children as causing much unpleasantness and distraction from more essential things. Epicurus agrees with him, as do all who place the good in pleasure and freedom from trouble or freedom from distress.
[Cf. **D139–42**; THEODORETUS *Cure for the Ills of the Greeks* XLI.74.]

192. PLUTARCH *Non Posse* 19, 1100b–c

Surely people who are so keen on praise and glory have to admit that they give up great pleasures through weakness or cowardice by shunning office and political power and the friendship of kings, which Democritus says are the source of what is great and splendid in life.
[Cf. *Against Colotes* 32, 1126a

Democritus urges us to become expert in the art of war, which is of the greatest importance, and to undertake heavy labours, which are the source of what is great and splendid for people.]

193. EPIPHANIUS *Against Heresies* III.14

Democritus son of Damasippus from Abdera said that the world is infinite and that it is situated over a void. And he said that everything has a single end, and that cheerfulness is the greatest thing, and that distresses

137 Diels and other editors assume a lacuna and suggest a variety of supplementations. Langerbeck 11, pp. 64–5 takes the text to be complete, translating 'Joy and sorrow are the distinguishing mark of those who have reached maturity' [i.e., when people have reached maturity their characters are, as in Aristotle's theory, distinguished from one another by their likes and dislikes]. Cf. n. on **D26**.

determine what is bad. And what seems to be just is not just, and the opposite of what is natural is unjust. For he said that the laws are a wicked contrivance, and 'The wise man should not obey the laws, but live as a free man.'

194. DAVID *Prolegomena to Philosophy* 38.14–21

And just as we see in the universe some things which do nothing but rule, i.e., the gods, and some which both rule and are ruled, i.e., human beings (for they are ruled by the gods and rule the non-rational animals), and some which are simply ruled, i.e., the non-rational animals, in the same way we see this in man, who is a small world as Democritus says. Some things in man do nothing but rule, i.e., reason, some both rule and are ruled, i.e., spirit ... and others are simply ruled, i.e., desire.

ATOMISM AND LATER PHILOSOPHY

[It goes beyond the scope of this work to attempt to examine the influence of the atomism of Leucippus and Democritus on later Greek philosophy in general, and on Epicureanism in particular. The selection of texts given in this section has a much more modest purpose, viz. to present the evidence firstly (section I) of the historical connection between fifth-century atomism and the sceptical school traditionally founded by Pyrrho, and secondly (section II) of the reception of atomism in the Epicurean school. The latter includes both doxographical reports of associations of various sorts between atomists and Epicureans, and references to the atomists in Epicurean works, from those of Epicurus himself down to the inscription composed by Diogenes of Oenoanda in the second century AD. Other passages of both kinds are included in earlier, thematic sections: see **34**, **87**, **110f** (Lucretius), **60e**, **74b**, **86b**, **112a**, **131b**, **172b–c** (Cicero), **133a**, **178c** (Plutarch), **60a** (ps-Plutarch), **179d** (Galen), **180** (Sextus), **14a** (Athenaeus), **2**, **14b** (Diogenes Laertius), **63a** (Eusebius), **172d** (Augustine), **47b** (Philoponus) **50a** (Simplicius).]

DEMOCRITUS AND THE SCEPTICAL TRADITION

195. DIOGENES LAERTIUS IX.67

Philo of Athens, who knew him [i.e., Pyrrho], said that he used to refer to Democritus above all ...

196. EUSEBIUS *Praeparatio Evangelica* XIV.6.4

Pyrrho started from Democritus in a sense.

[Cf. **4b**, **198b**.]

197. SEXTUS *Against the Mathematicians* VII.53

Xeniades of Corinth, who is mentioned by Democritus, [maintained that] everything is false, and every appearance and opinion is false.[138]
[Cf. **180, 184b**.]

DEMOCRITUS AND THE EPICUREAN TRADITION

198. a. DIOGENES LAERTIUS I.15

[A philosophical succession] Zeno of Elea, who taught Leucippus, who taught Democritus, who had many pupils including Nausiphanes and Naukydes; Epicurus was a pupil of theirs.
[Cf. **2**.]

b. CLEMENT *Miscellanies* I.64 [continuing **4a**]

Democritus' pupils were Protagoras of Abdera and Metrodorus of Chios; the latter taught Diogenes of Smyrna, who taught Anaxarchus, who taught Pyrrho, who taught Nausiphanes; some say that Epicurus was a pupil of the latter.

199. DIOGENES LAERTIUS X.2

Hermippus says that he [i.e., Epicurus] was a schoolmaster, who turned to philosophy on coming across the writings of Democritus.

200. DIOGENES LAERTIUS X.4

[Reporting various hostile statements about Epicurus by writers of other schools] And that he passed off as his own the views of Democritus on atoms and Aristippus on pleasure.

201. DIOGENES LAERTIUS X.8

[Epicurus called] Democritus 'Lerocritus' [i.e., 'judge of rubbish'].[139]

202. PHILODEMUS *Against the ?* Herculaneum papyrus 1005, fr. 10.8–12 Sbordone, 116 Angeli [= **104** Arrighetti]

The man who gathered together in Teos the mutilators of the Hermai to philosophize according to the principles of Democritus and Leucippus. [The reference is probably to Nausiphanes, who came from Teos.]

203. a. CICERO *De Natura Deorum* I.26.73

He [i.e., Epicurus] stands convicted in the case of Nausiphanes the Democritean; he does not deny that he attended his lectures, yet he loads

138 See Brunschwig 119.

139 On the signification of this nickname see Sedley 128, Huby 125, Gigante 123, ch. 3.

him with every kind of abuse. But if he had not heard those Democritean teachings, what had he heard? What is there in Epicurus' scientific doctrines which is not taken from Democritus? For although he made a few changes, as in what I said a little earlier about the swerve of the atoms [I.25.69], still most of what he said was the same, atoms, void, images, infinite space, innumerable worlds, and their growth and decay, virtually everything which goes to make up his account of nature.

[Cf. I.33.93; *De Finibus* I.6.17–18, 20–1, II.31.102, IV.5.13; *Academica* I.2.6.]

b. PHILODEMUS *On Freedom of Speech* Herculaneum papyrus 1471 fr. 20.5–10

... moreover, the pardon accorded to their errors, a position which Epicurus takes up throughout his Critique of Democritus ...

204. PLUTARCH *Against Colotes* 3, 1108e–f

Yet for a long time Epicurus used to call himself a Democritean, as is attested by many sources, particularly Leonteus, one of Epicurus' principal pupils, in a letter to Lycophron; he says that Democritus was held in honour by Epicurus for having anticipated him in getting hold of correct knowledge, and that his whole theory was called Democritean because he had anticipated him in coming upon the principles of nature. And Metrodorus says straight out in his *On Philosophy* that, if Democritus had not led the way, Epicurus would not have attained wisdom.

205. PLUTARCH *Non Posse* 18, 1099f–1100a

'But for all that Epicurus agrees that some pleasures come from one's reputation.' How would he not, since he was so crazily puffed up and fidgety about his reputation that he not only repudiated his teachers, fought over every syllable and comma with Democritus, whose doctrines he had filched word for word and said that no one had ever been wise except himself and his pupils ...[140]

206. PLUTARCH *Against Colotes* 8, 1110e–1111c

But even more in his second charge [cf. **178c**] he [i.e., Colotes] fails to see that he is expelling Epicurus from life along with Democritus. For he says that Democritus' statements that colour and sweetness and the compound[141] and the rest are by convention, but the void and the atoms in

140 On Epicurus' attitude to his predecessors, including the atomists, see Sedley 128, Huby 125.

141 Plutarch attributes to Colotes the view that according to Democritus not merely the secondary properties but also atomic aggregates themselves exist only by convention. On that view reality is merely a structureless totality of atoms moving in the void, while not

reality contradict the senses, and that someone who abides by this theory and applies it would not consider that he is a man or that he is alive.[142]

I have nothing to say in reply to this assertion, but I can say that these views are as inseparable from Epicurus' theories as they say shape and weight are from the atoms. For what does Democritus say? That an infinite number of atomic, undifferentiated substances, incapable of affecting or being affected, travel about, scattered in the void. And whenever they approach one another, come together or get entangled with one another, these collections appear as water, fire, a plant, or a man. Everything consists of the atoms, which he calls 'forms,' and there is nothing else. For there is no coming to be from what is not, and nothing could come to be from what is, since, because of their solidity, the atoms neither are affected nor change. Hence no colour comes into being from colourless things, nor any nature or soul from things which can neither affect nor be affected. So Democritus should be charged, not with drawing conclusions which agree with his principles, but with choosing principles from which those

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only the properties of aggregates but the very existence of aggregates is a construction imposed on that totality by observers. This doctrine takes observer-relativism beneath the level of phenomena to build it into the very structure of the world itself; just as, on the conventional view of atomism, the colour of an object is nothing more than the tendency of an atomic aggregate to look a certain way to suitably disposed observers, so on this view, the existence of an aggregate is nothing more than the tendency on the part of observers to agree that such an aggregate exists.

Pace Sedley 129, it is hard to accept that that can in fact have been Democritus' view. Not merely are the sources full of descriptions of atomic aggregates, but the very processes of perception and thought which such a doctrine relies on themselves presuppose such aggregates. For observers are themselves aggregates who are themselves caused to have perceptions and thoughts by the impact of *eidōla* (themselves a kind of aggregate) flowing off the aggregates surrounding them. Democritus might, indeed, be thought not to have grasped these implications of his own view (as Epicurus charges, in another context, in **208**), but rather than resort to such an extreme supposition it is easier to suppose some error in the transmission of this doctrine. Either Colotes misrepresented Democritus, or Plutarch misrepresents Colotes, or possibly the ms. text is at fault.

It is noteworthy that none of the other contexts (**179a–d**) in which **D16** is reported contains the words *nomōi sungkrisin*; all restrict the things said to be *nomōi* to the secondary qualities, and it is not impossible that *sungkrisin* here should be replaced by some word designating a secondary quality (e.g., *pikron*, as suggested by Sandbach). It is, however, more likely that the occurrence of the word reflects looseness in Colotes' terminology. Rather than applying the term strictly to the atomic aggregate, he may have intended it to apply to the observed macroscopic object, thought of as a bundle of qualities, and fathered on Democritus the view that that bundle, as well as the properties which compose it, exists only *nomōi*.

142 See Fowler 122.

conclusions follow. For he ought not to have posited changeless primary substances, but having posited them he should have seen that all qualities disappear. But it is altogether shameless to see the absurdity and then deny it. So Epicurus is being altogether shameless when he says that he posits the same principles, but does not say that colour is by convention, and sweet and bitter and the other qualities. ... It was not necessary to postulate, or rather to filch from Democritus, the doctrine that atoms are the principles of everything, but once having postulated it and swanked over its initial plausibilities he should have swallowed the bitter dregs, or else shown how corpuscles with no qualities produce every kind of quality purely by their juxtaposition.

[For the use of the term 'forms' (*ideai*) applied to atoms see **D7**.]

207. SEXTUS *Against the Mathematicians* IX.363

Democritus and Epicurus [said that the elements were] atoms, unless this doctrine is to be considered more ancient, and, as the Stoic Posidonius said, derived from a Phoenician called Mochos.

[Cf. STRABO XVI.757.]

208. EPICURUS fr. 34.30 Arrighetti

Those who gave an adequate account of causes from the beginning, far surpassing not only their predecessors but their successors too in many ways, though they alleviated many great evils, failed to see what they were doing in making necessity and chance the cause of everything. The very thesis which asserts this broke down and involved the man [i.e., Democritus] unawares in a conflict between his actions and his opinion, so that, had he not in his actions forgotten his opinion, he would have been in a continual state of self-induced confusion, succumbing to the most extreme consequences when his opinion prevailed, and full of conflict when it did not, through the opposition of his actions and his opinion.[143]

209. a. CICERO *De Finibus* I.8.28

I [i.e., the Epicurean spokesman Torquatus] shall prove that a great many errors committed by Democritus were criticized and corrected by Epicurus.

b. DIOGENES OF OENOANDA fr. 6 Smith, II.9–III.6

Democritus of Abdera was correct to say that atomic natures [are the elements]. But since he made some errors about them, he will be examined

143 See Laks 127, Gigante 123, pp. 56–60, Sedley 129.

in our opinions. And now we shall bring our charges against the men mentioned above, not in a contentious spirit, but desirous that the truth should be preserved.

c. DIOGENES OF OENOANDA fr. 7 Smith, II.2–14

Democritus made an error unworthy of himself in saying that only the atoms exist in reality, and everything else by convention. According to your theory, Democritus, we shall be unable, not merely to find out the truth, but even to live, avoiding neither fire nor murder ...

210. DIOGENES OF OENOANDA fr. 54 Smith, II.3–III.9

For if anyone follows Democritus' theory, saying that the atoms have no free motion, since they collide with one another, from which it appears that the motion of everything is necessitated, we shall say to him 'Do you not know, whoever you are, that the atoms have a free motion, which Democritus did not discover, but Epicurus revealed, namely the motion of the swerve, as he shows from the phenomena?'

[Cf. CICERO *De Natura Deorum* I.25.69.]

211. a. DIOGENES OF OENOANDA fr. 9 Smith, VI.3–13

We now reply to your theory as follows, Democritus. The nature of dreams is in no way sent from the gods, as you say, nor does it give advice. Rather, that which produces dreams is, I say, certain natures, so that the sophistical argument is deflected.

[The bulk of the text, including the name of Democritus, is restored.]

b. DIOGENES OF OENOANDA fr. 10 Smith, I.4–8, IV.10–V.14

The appearances are not empty fantasies of the mind, as the Stoics assert. ... On the other hand, if they are not empty they do not have perception and intelligence and actually talk to us, as Democritus supposes. For it is impossible that these attributes should belong in this way to thin films which lack the depth of a solid substance. These thinkers, the Stoics and Democritus, have gone wrong in opposite ways; for the Stoics deprive the appearances of the power they actually have, while Democritus concedes them in addition a power which they do not have.

c. DIOGENES OF OENOANDA fr. 43 Smith, I.12–II.14

These images have no perception whatever, as Democritus supposes, being constructed of atoms which are fine in texture and conceivable only in thought. If they have the shape of things in which our nature delights they please the soul greatly, but if of those things to which our nature is alien, they weigh the whole person down with much trouble and fear, and set the heart pounding.

[Cf. **133a–b.**]

['Democritus of Abdera' is named in fr. 173 Smith; the context is lacking.]

212. PHILODEMUS *On Vices* Herculaneum papyrus 1457, fr. 21 Bassi X.4–12

When Nicasicrates[144] praises Democritus for criticizing the attempt to please one's neighbours, on the ground that ingratiating oneself in that way is harmful, I do not see how he agrees with Epicurus and his followers ...

[Cf. PLUTARCH *Political Precepts* 28, 821a

The politician will not despise considerations of his reputation and avoid pleasing his neighbours, as Democritus said he should.]

213. PHILODEMUS *On Music* Herculaneum papyrus 1497, col. XXXVI.29–39

Democritus, a man who was not only the most learned about nature of all the ancients but no less industrious than any other inquirer, says that music is more recent, and identifies its cause, saying that it was not singled out by necessity, but arose as a result of plenty.

214. PHILODEMUS *On Piety* Herculaneum papyrus 1428, fr. 16.2–11

Thence summer and winter and spring and autumn and all these things are sent from above by the gods, and so they recognize and venerate their author. Democritus does not seem to me, like some ...[145]

[Cf. **173a**; **D14**.]

215. PHILODEMUS *On Death* Herculaneum papyrus 1050, col. XXIX.27–32

According to Democritus putrefaction is the source of disgust at the smell and hideous appearance [of corpses].

[A later fragment of the same papyrus, col. XXXIX.9–15, cites a remark of Democritus about people who are too frightened at the thought of death to bring themselves to make their wills. Reconstruction and hence sense are disputed. Diels and others restore δίσσ' ἐμφορεῖν, 'stuff themselves with double portions,' the sense of which is obscure. Gigante and Indelli 124 restore διχ' ἐμφορεῖν, suggesting that the meaning is 'write down conflicting provisions' (sc. in their hastily drafted wills). That sense too appears strained, while there appears to be no firm support for the use of the verb ἐμφορέω in the required sense.]

[The name of Democritus occurs in two other fragments of Herculaneum papyrus 1005, [see **202**], fr. d^4.1–6 Sbordone, 59 Angeli, and fr. l^3.14–19 Sbordone, 111 Angeli [= **113** Arrighetti]: also in Herculaneum papyri 1788, fr. 2.7 and 327, fr. 1. The contexts are too fragmentary to allow significant translation.

144 Mentioned several times by Philodemus, but otherwise unknown; perhaps an Epicurean. See *RE* XVII.1, 281–3.

145 See Henrichs 85, Montano 88.

Another fragment of papyrus 1788 (fr. 1, printed by DK as 67 B1a and 68 B4b) was conjecturally restored by Crönert to mention alleged plagiarism by Democritus in his *Lesser World-System* of the *Great World-System* of Leucippus. But though the extant letters appear to mention the latter work, they contain neither the name of the former nor that of either philosopher. Any restoration must be conjectural.

The name of Democritus also appears in *Florentine Papyrus* 115 (eds. Powell and Barber 1929 (= *CPF* I* 9.1T)) dealing with the question of how a new-born infant knows how to seek the breast [cited under **136**: cf. AETIUS V.16.1]. It has been suggested that Colotes might be the author, though more recently it has been suggested that the source may be a work of Galen discussing Hippocrates. See Fowler 122, p.241, di Benedetto 121.

See also **D35**.]

COMMENTARY

LIFE AND WORKS

Atomism was the creation of two thinkers, Leucippus and Democritus. The former, attested by Aristotle, our primary source, as the founder of the theory (e.g., **46a**, **48a**), was a shadowy figure even in antiquity, being eclipsed by his more celebrated successor Democritus to such an extent that the theory came to be generally regarded as the work of the latter, while Epicurus, who developed and popularized atomism in the third century BC, went so far as to deny that Leucippus ever existed (**2**).[1] Nothing is known of his life. Even his birthplace was disputed, some sources associating him with one or other of the two main centres of early Greek philosophy, Miletus and Elea, others with Abdera, the birthplace of Democritus (**1**). Of his dates all that can be said is that since he was certainly older than Democritus he lived during the fifth century. No lists of his works survive. The catalogue of Democritus' works preserved by Diogenes Laertius (**40**) contains a note that the work entitled *Great World-System* (*Megas Diakosmos*), listed there as written by Democritus, was ascribed by the school of Theophrastus to Leucippus, and the single quotation ascribed to the latter by a single ancient source (Stobaeus; **L1**) is said to come from a work entitled *On Mind*, which may have been a separate work from the *Great World-System* (assuming that to be the work of Leucippus) or possibly a portion of it.

Only a little more is known about Democritus. He came from Abdera, on the north coast of the Aegean (also the birthplace of Protagoras), and

1 Though Epicurus' scepticism (if that is what it was, rather than a negative evaluation of the significance of Leucippus) is shared by some modern scholars, most recently Lebedev 20 (for earlier discussions see Guthrie 9, p. 383, n. 2), the overwhelming consensus is in favour of accepting Aristotle's evidence.

is reported (**6** (41)) as having described himself as young in the old age of Anaxagoras, i.e., probably in the 430s. He is traditionally said to have lived to a very great age (over one hundred years on some accounts) (**6** (39), **10–11**), and may therefore be supposed to have lived from about the middle of the fifth till well into the fourth century (though some scholars dispute the accounts of his longevity).[2] He is quoted (**D1**) as saying that he visited Athens (where no one knew him), and is said (**6** (36)) to have had some slight acquaintance with Socrates. The traditions that he travelled widely, visiting the sages of the east (**6** (35), **7, 18, 22**)[3] and that he held office in Abdera (**7**) may have some historical basis. Of his works, which according to the list preserved in Diogenes Laertius' *Life* (**40**) were many and encyclopedic in scope, including a complete account of the physical universe and works on subjects including astronomy, mathematics, literature, epistemology, and ethics, none survive. Ancient sources preserve almost three hundred purported quotations, the great majority on ethics (see below), but also including some important fragments on epistemology preserved by Sextus. Our knowledge of the metaphysical foundations and physical doctrines of atomism relies on the doxographical tradition originating from Aristotle, who discusses atomism extensively. The precise relation between Leucippus and Democritus is unclear. Aristotle and his followers treat Leucippus as the founder of the theory, but also assign its basic principles to both Leucippus and Democritus; later sources tend to treat the theory as the work of Democritus alone. While it is clear that the theory originated with Leucippus, it is possible that the two collaborated to some extent, and almost certain that Democritus developed the theory in a number of areas, including psychology and epistemology.

DOCTRINES

Atomism belongs to the most ancient tradition of Greek intellectual inquiry, instituted by the Milesian thinkers of the sixth century BC and continued in that century and the next by Heraclitus, Empedocles, and

2 For detailed discussions of the chronology see Stella 22, who argues for the Eusebian dating of c. 500–400 (supported by de Ley 18), Ferguson 19, arguing for the Apollodoran dating of c. 460–c. 360, and O'Brien 21, arguing for the Thrasyllan birthdate of 470/69 and 380/79 for the date of Democritus' death. Davison 17 disputes the tradition of Democritus' longevity. The only hard evidence is his own statement of his temporal relation to Anaxagoras.

3 Clement cites what purports to be Democritus' first-person claim that he had visited more lands and more notable people than anyone else (*Miscellanies* I.15.69 [= DK 68 B299]). The authenticity of this quotation is disputed.

Anaxagoras. The aim of thinkers in that tradition was nothing less than to give a speculative, but rationally controlled account of the nature of things in general, including the whole natural order and the place of man in it. Our sources attest that Democritus certainly and possibly also Leucippus wrote comprehensive accounts of the world order (see **40** (46)), while the list of Democritus' works (**40**) indicates activity in virtually every area of thought known to the ancients. The extent to which the atomists may have attempted to integrate these diverse subjects into a comprehensive system is a complex question; some connections, notably between their physical doctrines and their epistemology, are fairly clear, whereas others, in particular between atomistic physics and ethics, are matters of scholarly dispute (see below, under 'Ethics and Politics'). Nonetheless, the physical doctrines may fairly be considered as central, firstly in that it is via them that the atomists attempt to fulfil their primary task of providing a comprehensive account of the natural world, and secondly in that they are presupposed in at least some other areas of atomistic thought. Those doctrines must therefore be our starting-point.

The primary evidence for the physical doctrines of the atomists is not, regrettably, their own words. Of the fragments of Leucippus and Democritus only eight (the sole fragment of Leucippus and seven fragments of Democritus) concern the physical doctrines at all, and none of those deal with the fundamentals of the system. Consequently we must rely on reports and criticism of those doctrines by later writers. That tradition has three principal elements: (i) Aristotle's discussions of atomistic doctrines, (ii) the elucidation of those discussions by the Aristotelian commentators, (iii) the doxographic tradition deriving ultimately from Theophrastus. These sources must of course be treated with caution; in particular the reader must bear in mind that the primary authorities, Aristotle and Theophrastus, write rather as critics than as mere expositors of the philosophers whom they discuss. But caution should not be confused with excessive scepticism. The critical stance is not incompatible with the intention and the ability to represent accurately the views criticized, and a general position of interpretative charity should lead us to attribute that intention and that ability to our sources (especially Aristotle and Theophrastus) unless we have reason to the contrary. This study will be guided by that assumption.

Historically, atomism was one of the most influential philosophical systems of antiquity. As attested by the excerpts from his works included in this volume, Aristotle regarded it as presenting a serious challenge to his own system, especially in respect of its mechanism and repudiation of teleology, and consequently subjected it to sustained and detailed criticism. Its central physical doctrines were adopted, not without modifications, some

of them substantial, by Epicurus, and in that form became the foundation of the Epicurean philosophical system and way of life, which, together with Stoicism, largely dominated the thought and culture of the Hellenistic and Roman periods. The greatest monument of Epicureanism in the Roman world is Lucretius' didactic epic *De Rerum Natura* (*On the Nature of Things*), a work which synthesizes philosophical precision and poetic force to an extent unparalleled in Western literature (the nearest comparison is perhaps Dante's *Divine Comedy*). It was the rediscovery of this work in the fifteenth century which led to a revival of Epicureanism, whose most notable exponent was the sixteenth-century philosopher Pierre Gassendi. For Gassendi and others of this period the attraction of atomism lay largely in its opposition to the dominant Aristotelian conceptual model, particularly in its claim to offer genuine explanations of phenomena in terms of the basic physical properties of matter, conceived atomistically, in place of what were increasingly viewed as the non-explanatory concepts of formal and final causes. The 'Corpuscular Philosophy' provided the conceptual model for the leading scientists and philosophers of the sixteenth and seventeenth centuries, including Galileo, Descartes, Boyle, Newton, and Locke, and via that philosophico-scientific movement provided the conceptual underpinnings of the scientific world-view which remains dominant to the present day. While the details of the scientific conception of the basic constituents of the world have changed out of all recognition since the time of the ancient atomists (as is shown most vividly by the fact that we find the notion of splitting the atom quite unproblematic), the insight that the ultimate explanation of all physical phenomena is to be found at the level of micro-structure is the lasting legacy of ancient atomism.

BASIC PRINCIPLES

Atoms

Theoretical Role

The account of the fundamentals of atomism found in Aristotle and his commentators represents the theory as arising from the interplay of two opposed forces. On the one hand there was the acceptance of Eleatic limitations on the possibility of coming to be (*genesis*); nothing comes into being from nothing, while from what is truly one there could never come to be a plurality, nor from what is truly many one thing (**48a**). On the other was the desire to do justice to certain phenomena of common observation, notably the plurality of things, motion, coming to be and ceasing to be

(**48a**), and also, apparently, certain kinds of perceptual relativity (**42b**). In **48a** Aristotle expressly begins his critical account of atomism from the dialectic of these two motivations. It will be useful to say a few words about each individually.

In the fifth century various thinkers attempted to mitigate the Eleatic prohibition on *genesis* first by distinguishing the coming into being of new entities from the rearrangement of pre-existing entities, and secondly by arguing that the observable coming into being of such macroscopic objects as plants and animals (in turn a special case of the more general phenomenon of observable change) is in fact nothing more than rearrangement. In effect (though the terminology itself does not antedate Aristotle) this is to adopt a distinction between coming into being *strictly speaking* and qualified (or apparent) coming into being, and to identify the former with the coming into being of substances (thought of as primary or basic things) in contrast with the coming into being of states or interrelations of substances. Empedocles and Anaxagoras adopted different versions of this strategy, Empedocles identifying the basic things as the four elements and explicitly characterizing what is conventionally (and in his view wrongly) described as coming to be and ceasing to be as the mixing and separation of those elements (DK 31 B8 and 9), Anaxagoras treating sensible qualities and stuffs as the basic things and once again generating observable things from them by posited processes of separation and mixing (DK 59 B17). The atomists followed the same path; their basic things, the atoms, are ungenerated (**44a**), while the coming to be and ceasing to be of other things reduces to the formation and dissolution of aggregates of those basic things, i.e., to their joining and separation (**42a**; **44a**). But while they thus exemplify a standard response to the Eleatic rejection of *genesis*, we ought to ask why they did. Parmenides disallowed 'What is not' as a possible object of thought; hence what is could not have come into being from nothing or from non-being, both of which descriptions violate the proscription on thinking of what is not. Further, that proscription appears to have provided him with an argument that what is could not have come into being from something *else* which is; for something which is could not give rise to something *other* than itself, since what is other than what is is (impossibly) what is not (DK 28 B8, lines 12–13). Hence Parmenides rejects *all* coming to be, whether from nothing or from something. Someone who accepts his proscription on thinking of what is not, as Empedocles and Anaxagoras appear to have done, is then obliged to explain how apparent *genesis* is not genuine *genesis*, which is agreed to be impossible. But the atomists rejected the Parmenidean proscription; not merely is it possible to think of what is not, but what is not (i.e., the void) *is* no less than what is,

i.e., the atoms (**45, 46a**). So what ground did they have for their rejection of real *genesis*?

No argument on this point is explicitly attested, but some plausible reconstruction is possible. If an atom came into being, it would have to do so either from nothing, or from something already in existence. We have reason to think that the atomists would have rejected either alternative, and some evidence as to what their grounds may have been. Consider i, the hypothesis that it came into being from nothing. Against this Parmenides had already provided an argument independent of his principle that it is not possible to think of what is not. His words (DK 28 B8, lines 9–10) are

> For what need urged it, beginning from nothing, to come into being earlier or later?

These words are ambiguous, depending on whether 'earlier or later' is read as 'at any time' or as 'at any time rather than any other.' On the former reading the thought is that, since ex hypothesi there was nothing, nothing could have brought the atom into existence at any time. Hence the atom could not have come into existence at any time. Thus construed, that argument relies on the principle that every event has a cause; ex hypothesi an atom's coming into existence from nothing would have to be an uncaused event, hence by the principle no such event could have occurred. On the latter reading the thought is that, since ex hypothesi there was nothing, there was no reason for an atom to come into existence at any particular time rather than at any other time. But nothing occurs at any particular time without such a reason. Hence the atom could not have come into existence at any particular time. Hence it could not have come into existence. On either reading the underlying principle is the Principle of Sufficient Reason, that no event occurs, or state of affairs obtains, unless there is a sufficient reason for its occurrence or obtaining. There is also some textual evidence that the atomists employed that principle in various contexts. Simplicius reports (**45**) that they held that there is an infinite number of atomic shapes, since there is no more reason for them to be one shape rather than another, and Aristotle (**80c**) and Philoponus (**80d**) ascribe to Democritus the argument that there are infinitely many worlds, since in an infinite void there is no more reason for there to be a world in one place than in another. There is therefore some presumption that the atomists followed Parmenides in arguing against *genesis* ex nihilo by appeal to the Principle of Sufficient Reason.[4]

4 See further Makin 35, ch. 3; also Mugler 39, Luria 93.

What then of alternative ii, the hypothesis that an atom might come into existence from something already in existence? Given the atomists' hypothesis, the thing already in existence must be either an atom or an aggregate of atoms. In the former case we might imagine an atom dividing to form two successor atoms, in the latter the constituent atoms of the aggregate fusing to generate a successor identical with none of them. (We do not have to consider separately the splitting of an aggregate, since if an aggregate splits into its component atoms, the separate atoms do not come into existence (since they existed already), while the case of an aggregate's splitting to form atoms not identical with any of the components is a case either of splitting of components or of fusion, both of which are already considered.) Could the atomists have accepted that account of the *genesis* of atoms?

They would not, presumably, have felt obliged to reject it on the grounds that it generates an infinite regress, first because the regress requires the extra premiss that all atoms are generated from previously existing atoms, and secondly because they accepted a precisely analogous regress in their account of atomic motion and position. At any moment the motion and position of an atom is the causal product of a prior interaction of atoms whose positions and motions were the product of prior interactions, and so back ad infinitum (**53**). Believing as they did in an eternal universe (**44a**, **53**, **62**, **75**), the atomists had no reason to object, and did not object, to infinitely long causal chains. They did indeed reject the possibility of atomic fission and fusion, but on other grounds. Aristotle, stating their account of coming and ceasing to be (of complex objects) via atomic combination and separation (**48a**), adds the comment 'From what is truly one there could never come to be a plurality, nor from truly many one thing; that is impossible,' and elsewhere (**44a**) he ascribes to the atomists the view that it would be 'quite absurd' for two or more things ever to become one (cf. **44b**). The denial of the possibility of atomic fission follows from the indivisibility of the atoms (discussed in more detail below); fission is physical division, and it is uncontroversial that the atoms were at least physically indivisible (though precisely why is an interesting question). Atomic fusion is more problematic. They may have ruled it out on the assumption that it required atoms to interpenetrate, i.e., for parts of two atoms to occupy the same space at the same time. (Interpenetration must be distinguished from the unproblematic notion of interlocking like the pieces of a jigsaw puzzle. In that situation one atom occupies an empty space partially enclosed by another atom, and it is undisputed that atoms were conceived as interlocking to form aggregates, including perceptible objects (e.g., **44a**).) But why might not atoms fuse by coming into contact edge to edge, thus generating a physically continuous body, without its being the

case that any portion of space is occupied by more than one body at any time? Our evidence does not indicate whether the atomists had envisaged that as a possibility distinct from atomic interpenetration. If they had, their grounds for excluding it remain obscure.

The atomists' basic things, then, were ungenerated. Generation from nothing could be ruled out on Parmenidean grounds (see above), while generation from something else requires that atoms either divide or fuse, both of which are assumed to be impossible. But while the principle that two bodies cannot simultaneously occupy the same place provides a satisfactory reason for ruling out fusing (provided that edge-to-edge fusing is not separately envisaged), the denial of the possibility of atomic division seems so far unmotivated. We must therefore examine the atomists' grounds for holding that their basic entities were indivisible.

Divisibility

In **49** Aristotle cites an atomistic argument against the infinite divisibility of material things.[5] The essence of the argument is as follows. By the hypothesis, material things are divisible ad infinitum. Since such division is possible, imagine that it has actually been carried out; what then is left? Either the product of the division is a number of bodies with physical magnitude, or it consists of things which have no magnitude, i.e., either geometrical points, or mere nothings. In the former case the residual bodies are further divisible, i.e., the division has not been carried out, which contradicts the hypothesis. In the latter case the original body, which has magnitude, is composed of things which have no magnitude, which is impossible. So the hypothesis that material things are divisible ad infinitum is false. As has been frequently pointed out, this argument has affinities with Zeno's argument against pluralism, preserved by Simplicius (DK 29 B1–2). The first horn of the atomists' argument relies on the principle of Zeno fr. 1 that every magnitude is divisible, the second on that of fr. 2 that things with no size cannot be added together to produce something with size. It is not, then, implausible that Aristotle may have this argument in mind when he remarks (**48b**) that some people (i.e., the atomists) gave in to the argument from dichotomy by positing atomic magnitudes; the argument of Zeno fr. 1, which relies on the iteration ad infinitum of the division of a magnitude, is an example of the type of argument referred to by the ancients as 'the argument from dichotomy.'

5 On the argument see especially Makin 47 and Miller 48.

There is, however, a crucial difference between Zeno's focus of interest and that of the atomists. Zeno is trying to show that every magnitude must be infinitely large; his argument is that every magnitude is divisible into lesser magnitudes ad infinitum, and that an infinite number of magnitudes of finite size sums to an infinite magnitude. This argument is concerned purely with theoretical division. Physical division ad infinitum of every extended thing is not possible in practice, and even if it could be demonstrated that below a certain threshold physical division is theoretically, and not merely practically, impossible, the argument would not be weakened in the slightest. The atomists, on the other hand, are concerned to show that things cannot be physically divided ad infinitum. That emerges clearly from their question 'What will be left when the division has been carried through?' If this question is asked about mathematical division it is only too easily answered; suppose that the infinite mathematical division of an extension has been completed, what will be left will be exactly what was there at the start, viz. the original extension. But if we think instead of physical separation, the force of the dilemma is clear. Imagine the original extension to have been separated into infinitely many subparts; then we are left either with an array of extended things, each requiring further subdivision, or with a set of unextended things. (Aristotle, or perhaps his source for the argument, points up the physical nature of the supposition by imagining the supposed third alternative that what is left is a pile of sawdust; of course this is merely a picturesque redescription of the first alternative, since the grains of sawdust are themselves extended objects.) On the other hand, while the argument appears intended to show that physical division ad infinitum is impossible, the grounds of the alleged impossibility are conceptual. Democritus is not making the uninteresting claim that there are some things which are too hard to be crushed, or too small to be cut by any edge which we can manufacture. Limitations of that kind are merely technological. Rather his argument is that if our picture of the world is not to collapse into incoherence, we must suppose that physical division has a theoretical limit.

Our discussion so far has indicated that a simple dichotomy of physical vs. theoretical indivisibility is inadequate. We have to distinguish three possible theses:

(i) It is in fact (i.e., physically) impossible to divide an atom physically,
(ii) It is theoretically impossible to divide an atom physically,
(iii) It is impossible to divide an atom conceptually (i.e., mathematically).[6]

6 Cf. Makin 47. Löbl 12, pp. 226–7 and 13, pp. 140–1 makes the same tripartite distinction in slightly different terminology, applying the term 'theoretical or ontological indivisibility'

The theses above are listed in increasing order of strength: iii entails i and ii, and ii entails i, but i does not entail ii and neither i nor ii entails iii. I take it as uncontroversial that the atomists maintained i, and have argued above that Aristotle's evidence in **49** indicates that they also maintained ii. Scholarly debate has raged around ii and iii: did the atomists distinguish the two theses? If so, did they maintain both, or only one? If the latter, which? (Though iii entails ii, we must allow for the possibility that the atomists did not recognize the entailment, thus adhering to iii without commitment to ii.) If not, did they maintain a thesis which was undifferentiated between ii and iii?

The Zenonian argument, as we have seen, supports thesis ii: unless some things are physically indivisible, matter is physically divisible ad infinitum, yielding the impossible result that a body which has magnitude is composed of parts which have no magnitude. In addition, the atomists seem to have had an independent reason for holding thesis ii. In **48a** Aristotle cites as their doctrine that 'each of the indivisibles is incapable of being affected (for it cannot be affected except through the void)'; this is confirmed by the statements of Eusebius (**50j**) that an atom is so called 'because it cannot be cut, since it cannot be affected and contains no void' and Simplicius (**57**) that the atomists' basic things were 'incapable of being affected because they were solid and lacking in void; for they said that division occurs in bodies by means of the void,' and by the evidence of Cicero (**62**), Diogenes Laertius (**6** (44)), Plutarch (**206**), and further passages of Eusebius (**63a**) and Simplicius (**50h, i**), all of which attest that the atoms were indivisible because of their solidity (*sterrotēs, nastotēs,* soliditas). On this conception bodies split along their interstices; hence where there are no interstices, as in an atom, no splitting is possible. On the question of why a body can be split only along its interstices we can do no more than speculate. It may have been asserted without grounds, as entirely obvious. But it is tempting to connect it with the Principle of Sufficient Reason, which we have already seen the atomists using. Given the total uniformity of an atom, they may have assumed that there could be no reason why it

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to the indivisibility maintained in thesis ii. Barnes 7, ch. 17 (*c*), distinguishes conceptual from mathematical indivisibility, understanding the thesis that atoms are conceptually indivisible as the thesis that they are too small to be imagined or conceived. I share his view that conceptual indivisibility in that sense is not at issue in this argument. In my own use of the terms, 'conceptually indivisible' and 'mathematically indivisible' are synonymous; the thesis that an atom is mathematically or conceptually indivisible is just the thesis that, necessarily, it has no mathematically distinguishable parts. I do not think that anything hinges on the use of the term 'conceptually.'

should split at any point, or in any direction, rather than any other. Hence by the Principle of Sufficient Reason, it could not split at all.

We have, then, firm evidence that the atomists maintained thesis ii, and can cite reasons for their doing so which appeal to metaphysical principles which it is plausible to ascribe to them. When we turn to thesis iii the situation is much less clear. For a start, their theory contains compelling grounds for *rejecting* that thesis. For, even if we set aside the doxographical evidence that some atoms were very large (Eusebius **63a**) or even as large as a world (Stobaeus **60b**), it was a basic datum of the theory that atoms are of different shapes and sizes, since differences of shape and size are among the fundamental causal properties of the atoms (see, e.g., Theophrastus (**113**) on the role of these differences in the explanation of perception, and Diogenes Laertius (**77a**) and ps-Plutarch (**79a**) on their role in cosmogony). But postulation of differences of shape and size between atoms is incompatible with acceptance of thesis iii. According to that thesis it is impossible to divide an atom conceptually, i.e., to distinguish in thought between one part of an atom and another. But in that case it is impossible (i) to ascribe a shape to any atom, (ii) to differentiate one atom from another in respect of size. As regards shape, since any shape is geometrically divisible (e.g., by its axis) into conceptually distinct parts, the denial of the possibility of the distinction of such parts entails the denial of shape altogether. As regards size, if two atoms differ in size, the larger exceeds the smaller by some part of itself; hence, where there are no parts there are no differences of size.

There were, then, the strongest of theoretical reasons for the atomists to deny that atoms were conceptually indivisible. Moreover, some textual evidence indicates that they did in fact deny it. The clearest and most explicit passage is Simplicius **50h** where, in distinguishing various senses of the word 'indivisible' (*adiairetos*), he explicitly distinguishes conceptually indivisible things, of which his examples are the point and the monad (i.e., the unit), from 'what has parts and size, but is incapable of being divided because of its solidity and fullness, e.g., each of the atoms of Democritus.' Other passages are less unambiguous. Alexander (**46b**) and Themistius (**46c**) both mention notionally distinguishable parts in the context of atomistic theories, but each passage has certain peculiarities which suggest that their account of fifth-century atomism may have been contaminated by other sources. Alexander says that Leucippus and Democritus postulate, as parts of the atoms, elements which are themselves partless, which suggests a possible confusion with the theory of Epicurus, while Themistius writes mysteriously (in a version of the lost Greek original transmitted via Arabic and Hebrew) of a principle which admits of notional division into seven parts but no further, an obscure remark which finds no echo in other

sources, and which, with its vague hint of number-mysticism, sounds dubious as an account of atomism. Aristotle argues (**54a**) that 'not even on their [i.e., the atomists'] own hypothesis does it seem that the elements would be infinite, if the bodies differ in shape, and all shapes are composed of pyramids, straight-edged shapes from straight-edged pyramids, and the sphere from eight parts.' There are a number of difficulties in this passage. First, is Aristotle identifying the thesis that all shapes are composed of pyramids as part of the atomists' own hypothesis, or is he introducing it as an extra assumption by means of which to derive an unacceptable conclusion from their actual hypothesis? Second, if he ascribes that view to the atomists, is his testimony reliable? These questions are not independent of one another, since the less plausible the ascription of that view to the atomists appears, the more attractive is the suggestion that Aristotle does not intend to ascribe it to them. The attribution of that thesis to the atomists is certainly suspicious, since no other evidence supports the suggestion that they regarded the pyramid as the basic shape from which the infinite variety of atomic shapes was built up; indeed the very idea of a basic atomic shape is absent from the bulk of the sources, which emphasize instead the variety of shapes. Moreover, Simplicius (**45**) explains the infinity of atomic shapes by the Principle of Sufficient Reason; there are infinitely many atomic shapes because there is no reason for an atom to be of one shape rather than another; it is hard to reconcile that evidence with the identification of any particular shape as primary. In view of these considerations it is perhaps more economical to conclude, with Simplicius in his commentary, that in this passage Aristotle is using the hypothesis of the pyramid as the basic shape as an extra assumption to derive a difficulty from the atomists' own assumption, viz. that there are many atomic shapes, than to take him to be explicitly attributing the former assumption to the atomists. This passage therefore falls short of providing firm confirmation to the evidence of Simplicius in **50h** that the atomists attributed conceptually separable parts to the atoms. Still, when that evidence is added to the theoretical grounds cited above, grounds requiring the atomists to recognize such parts, the case in favour of attributing that recognition to them is quite strong.

The evidence on the other side is of two kinds. First we have various explicit statements that the atoms had no parts. The simple statements of ps-Plutarch (**50b, f**) that the atoms were partless are inconclusive, since the term 'partless' (*ameres*) is ambiguous between 'having physically separable parts' and 'having conceptually distinguishable parts,' which is precisely the question at issue. What we need is a context where that distinction is drawn, whether explicitly or implicitly. Such a context seems prima facie to occur

in **50a**, where Simplicius reports that Leucippus and Democritus held that atoms are indivisible, not merely because of their inability to be affected, but also because of their smallness and lack of parts, and that Epicurus abandoned the doctrine of partlessness (so Simplicius conjectures) on the strength of Aristotle's criticism of it in the writings of the fifth-century atomists. Since it is acknowledged that the Epicurean atomic parts are conceptually separable, Leucippus and Democritus must have denied that there are any such parts. But we have just seen that the most important piece of evidence for their having held their atoms to have such parts, **50h**, is also from Simplicius, from the same work, moreover, as **50a**. Either we have a direct self-contradiction, or the two passages must be harmonized. Now in **50h** we have a contrast between physical things, atoms, and non-physical things, the point and the unit, and between a physical property of the former and a necessarily non-physical property of the latter. In **50a** the explicit contrast between the physical and the non-physical is absent. Rather, Simplicius there distinguishes two explanations of the indivisibility of the atom, on the one hand inability to be affected and on the other smallness and partlessness. It is possible that what is being distinguished is not two kinds of indivisibility, physical and conceptual, but two distinct, though connected, theoretical explanations of physical indivisibility; since the atom contains no void, it is theoretically impossible to separate parts of it physically (i) because the lack of void makes it incapable of being affected, (ii) because the absence of void guarantees that it has no physically separable parts. In that case the contrast with the Epicurean theory is confused, since the Epicurean parts are theoretically, not physically, separable. And Simplicius compounds the confusion by associating partlessness with smallness, since there is no logical connection between smallness and absence of void. On this interpretation **50a** is certainly confused, but that is surely less implausible than the downright contradiction between **50a** and **50h** which results from the standard interpretation.

There remain the statements of Aristotle (**50c**, **54a**, **55b**, followed by Simplicius and Philoponus (on **50c**) and a scholiast on Euclid X.1 (**50d**)) that the atomists' postulation of indivisible bodies conflicts with mathematics. Since mathematics requires conceptual but not physical divisibility ad infinitum, Aristotle must have understood the atomists as committed to denying the former as well as the latter. His criticism does not require that the conceptual indivisibility of the atoms was itself part of atomic theory, or even that it was a logical consequence of the *postulates* of the theory; it would be enough for Aristotle if the atomists' *arguments* for physical indivisibility were seen by him as having the (possibly unintended) consequence that the atoms were conceptually indivisible. And that that is

how Aristotle interpreted the atomists appears from **49**. There he attributes to them the argument that if physical division of matter ad infinitum is conceptually possible, it could happen. But if it had happened, the result could not be things with any physical magnitude, since ex hypothesi such magnitudes could be further divided physically. That is to say, the conceptual divisibility of a continuum entails the conceptual possibility of the physical division of that continuum. Hence by contraposition the conceptual impossibility of physical division entails conceptual indivisibility.

Now of course an atomist ought not to accept the principle that the conceptual divisibility of a continuum entails the conceptual possibility of the physical division of that continuum, since their theory required them to posit physical continua (i.e., atoms) which are for independent reasons physically unsplittable in theory. Perhaps the atomists simply failed to make that distinction; in that case Aristotle's report in **49** may be read as evidence of that failure. There is, however, another way of reading that report, more favourable to the atomists, though correspondingly less favourable to Aristotle. In his report the atomists are arguing against opponents who say simply that matter is physically divisible at every point. I.e., *on their opponents' assumption* conceptual divisibility entails the possibility of physical division. Relying on that assumption, together with the principle that what is possible may be actual, the atomists challenge their opponents to envisage the actualization of the possibility of division ad infinitum, and allege that the result is incoherence. It appears, then, from **49** that Aristotle's view that atomism conflicted with the foundations of mathematics may have arisen, in part at least, from his having treated a principle assumed ad hominem as if it were one of their own principles. If that is so, it is an obvious possibility that the atomists may themselves have contributed to the misinterpretation through lack of clarity on the subtle distinction between conceptual divisibility and the conceptual possibility of physical divisibility. That they did so pervasively is, of course, also possible, though unverifiable. A further possibility, suggested by Barnes 7, ch. 17 (*c*), is that Aristotle himself, who regarded geometry as essentially an applied science descriptive of idealized physical items (in Aristotelian terms, of things not separate considered as separate, e.g., *De anima* 431b15–16, *Physics* 193b30–5), may have assumed that the atomists' postulate of physical indivisibility was inconsistent with the geometrical postulate of conceptual divisibility ad infinitum. Such an assumption would certainly facilitate the misinterpretation just suggested. The Aristotelian evidence does not, therefore, seem to require us to conclude that the atomists committed themselves to the conceptual indivisibility of the atoms, as opposed to the conceptual impossibility of their being physically divided.

Their espousal of the latter thesis is sufficient to explain that evidence, via various hypotheses, each severally sufficient to explain the data, any or all of which may be true. These hypotheses are: (i) the atomists did not themselves clearly distinguish conceptual divisibility from the conceptual possibility of physical separation; (ii) Aristotle (perhaps partly because of i) either himself failed to make that distinction or, having made it, assumed that the atomists' rejection of the latter committed them to rejecting the former; (iii) Aristotle (perhaps partly because of i or ii) misread an atomistic ad hominem argument as relying on an assumption of their own. I do not find myself in a position to make any choice between these hypotheses. (See further on mathematics below.)

Differentiating Properties of Atoms

Thus far, the properties which we have seen to be ascribed to the atoms are those determined by their status as basic substances. They are ungenerated physical simples, the basic constituents of the compound things which populate the observable world. Being simple, they contain no internal gaps (since a gappy thing would be a scattered collection of items instead of a single item), and are hence physically indivisible in theory as well as in practice. As well as having no beginning, they have no end (**44a**). The atomists may have taken it that indivisibility guaranteed indestructibility, and therefore everlasting existence, on the assumption that the only way in which something can be destroyed is by being split up, whether by external force or by internal decay. But what guarantees that an atom might not be annihilated without being split? If the atomists considered that question, we do not have their answer. (The supposition that an atom might simply cease to exist, without being caused to do so by any external force or internal change, even were it envisaged by the atomists (of which there is no evidence) would presumably have been ruled out by the Principle of Sufficient Reason.) In these respects atoms are all alike, since all have the same theoretical role as physical elements. But that same role requires the existence of differences between atoms; for basic substances are basic, not merely constitutively, but also causally (see above). It is their properties which account for the observable differences between atomic aggregates; hence in addition to the similarities we have noticed, there must be certain qualitative differences between atoms. Aristotle tells us (**46a**) that there were just three differentiating properties, shape, arrangement, and position, for which he gives the atomistic technical terms, respectively 'rhythm,' 'contact,' and 'turning.' This gives the important information that the causally significant properties of the atoms included both intrinsic

and relational properties; i.e., the properties of aggregates depend both on the character of their constituent atoms and on the way those atoms are put together. (Arrangement and position, i.e., spatial ordering and orientation, are relational properties in that they consist in the spatial relations of atoms to other things, in the first instance towards other atoms. They are independent of one another; relative to a given spatial framework (provided, of course, by other atoms), a pair of, e.g., pyramidical atoms might change their relative ordering (e.g., reverse top and bottom) while preserving their relative orientation (e.g., keeping their bases adjacent to one another), or preserve ordering while changing orientation (e.g., bringing their apexes into contact with one another).) Aristotle's testimony in these passages is, however, faulty in one respect; he cites shape as the only intrinsic property of the atoms which differentiates them and is causally operative at the macroscopic level. Yet we have already noticed abundant evidence of the causal role of size, another intrinsic property, and Aristotle himself cites it as such in the passage from *On Democritus* cited by Simplicius at **44a**. (Our evidence nevertheless indicates that the atomists regarded shape as the fundamental intrinsic property; at **42a** Aristotle describes Democritus and Leucippus as having 'posited the shapes,' which is clearly equivalent to 'posited the atoms.' This usage may reflect the atomists' own terminology; according to Plutarch (**206**) Democritus called the atoms *ideai*, i.e., forms or shapes, and this testimony is confirmed by the occurrence of the term in **D7**. In the passage just cited Aristotle emphasizes variation of shape as the basic causal variable; cf. Philoponus **43c**, 'the formal causes were the shapes of the atoms.')

Shape, size, indivisibility, and spatial arrangement (of two kinds, ordering and orientation) are therefore the basic properties of the atoms. Why these properties? Here we should recall that atoms are unobservable; hence their properties have to be ascribed to them on the strength of their theoretical role, which is itself defined by the theoretical world-picture into which they fit. As Aristotle emphasizes (**42a, 48a**), that picture is grounded in observation; the world as we observe it is a world containing many physical things which come into and pass out of existence and which move. Hence plurality, generation, corruption, and motion are among the data which a theory of the nature of things has to account for. Another observable fact about the things in the world is that they are aggregates; individuals of different kinds, such as plants and animals, are visibly composed of diverse parts, blood, bones, bark, leaf tissue, etc., and stuffs such as flesh and bone are, again visibly, divisible into smaller parcels of the same stuff. We noted earlier the atomists' grounds for supposing that the

basic simples must be physically indivisible. So, everything observable is composed ultimately of physically indivisible items. But we can, if not directly observe, at least plausibly infer from what we can observe that nothing observable is physically indivisible; noting such phenomena as erosion, we may infer that even adamant wears away in the fullness of time. So the physically indivisible constituents of everything must be unobservable, and the most plausible explanation of their unobservability is that they are too small to be perceived. Physical aggregates, then, consist of (presumably) enormous numbers of minute physical particles; but how are these particles connected, so as to form the relatively stable aggregates which we observe? As we saw, they cannot be fused together; they must therefore interlock (**44a**, **54b**), which in turn requires that they are of appropriate shapes and sizes. The atomists clearly assumed that interlocking atoms must be of *different* shapes and sizes, despite the logical possibility of a universe composed of interlocking atoms of the same shape and size. We know from Simplicius (**45**) that they applied the Principle of Sufficient Reason to diversity of shape, arguing that there must be atoms of infinitely many shapes 'since there is no more reason for them to be one shape than another.' Perhaps that same argument was used to exclude a single shape common to all atoms; given that many such shapes are possible, there is no reason for all atoms to be of any one rather than any other. Given infinite diversity of shape it follows immediately that there must be infinitely many atoms, which we know the atomists to have asserted (e.g., **44a**), though whether they derived that thesis from the infinite variety of atomic shapes is uncertain.

One would expect parity of reasoning to have led them to maintain that, for the same reason that there are infinitely many varieties of atomic shape, so there are infinitely many gradations of atomic size, but here the evidence is ambiguous. First, no source explicitly states that they argued from the Principle of Sufficient Reason to an infinity of gradations of size. Aristotle does say (**44a**) that the atoms, while 'so small as to escape our senses ... have all kinds of forms and all kinds of shapes and differences of size.' But first the adjective *pantoios* (lit. 'of all kinds') is omitted before the phrase 'differences of size,' and while it is plausible to supply it before that phrase, the supplement is not mandatory; it is possible, though perhaps unlikely, that Aristotle intends to *contrast* 'all kinds of forms' and 'all kinds of shapes' with the *unqualified* 'differences of size,' to give the sense 'all kinds of forms and all kinds of shapes, as well as [sc. many] differences of size.' Second, even if *pantoios* is to be supplied, it is not clear that the adjective, in all its occurrences in this sentence, is to be read literally,

as implying 'infinitely many,' rather than more loosely, as implying 'a great many.' Third, Aristotle is clear (loc. cit.) that there was an upper bound to the size of atoms, viz. the threshold of perception. (Cf. **48a**, '[W]hat really is is ... infinitely many things, invisible because of their small size.') Had the atomists argued explicitly for an infinite gradation of atomic sizes below that upper bound, they would have had to be clear on the distinction between conceptual divisibility and the conceptual possibility of physical divisibility, to a degree which is difficult to reconcile with the evidence considered earlier. On the other side is the deviant evidence from Dionysius (via Eusebius) and Stobaeus mentioned above to the effect that according to Democritus some atoms were very large, or even as large as a world.[7] It is possible that that evidence represents a confused response to some arguments of Epicurus (*Letter to Herodotus* 55–7), in which he argues first that if there were atoms of every size some would be perceptible, which contradicts the phenomena, and then (following Zeno fr. 1) that any body which had infinitely many parts would be infinitely large. The doxographers will then have taken Epicurus' argument as Democritus', and, assuming that the latter accepted infinite gradations of size among the atoms, concluded that he accepted the counter-intuitive conclusions. Another hypothesis is, however, possible. This is that Democritus, perhaps on grounds of the Principle of Sufficient Reason, did accept that there are atoms of every possible size, and hence that there are atoms as large as you like, for which 'as large as a world' may be a picturesque metaphor. But what of Aristotle's explicit statements that the atoms are all too small to be perceived, and the numerous other descriptions of them as very small (e.g., **50a, 63a**)? It is possible that that is true of the atoms in our world, but that others of the infinitely many worlds in which the atomists believed (**80**) contained atoms of the infinite range of sizes above the threshold of perception.

To sum up, it is indisputable that the atomists believed that there were some differences in size among atoms, and probable (on the strength of Aristotle's evidence) that they believed that there were very many. Also from Aristotle we may take it that all the atoms in our world are so small as to be imperceptible. Our evidence leaves room for doubt whether they believed (i) that there are infinitely many gradations of atomic size, (ii) that

7 Bicknell 25 makes the interesting suggestion that a cosmos-sized atom need not be (by our standards) large. If there is an infinite range of atomic sizes, then some of the infinitely many worlds might be composed of atoms so small that such a world would be no bigger than an atom in our world. Cf. Leibniz, *Monadology* 66 '[I]t appears that in the smallest particle of matter there is a world of creatures, living beings, animals, entelechies, souls.'

(presumably elsewhere in the universe) there are atoms of sizes up to the enormously (conceivably even infinitely) large.[8]

The atomistic theory of observable objects as structures of simple, interlocking components thus leads to the identification of shape, size, arrangement, and orientation as the causally significant properties of the atoms, since it is those properties and those alone which determine the character of the observable structures. But why are those properties *alone* causally significant at the atomic level? Surely the character of an aggregate would be affected if some of its atoms were, say, elastic or soluble. But such properties were presumably thought to be excluded by the absence of void within the atom,[9] which we in turn saw to be required by its role as a physical simple. Nor can the theory allow us to count among the causally significant properties of the atoms the secondary qualities, colour, taste, sound, and smell. This claim, and the grounds for it, need to be stated with some care.

Secondary Qualities

It might seem obvious that the atoms, being imperceptible because of their smallness, can *have* no secondary qualities, since the latter are necessarily perceptible. Hence a fortiori the secondary qualities cannot figure among the causally significant properties of the atoms. But first it is not clear that things which are imperceptible simply because they are too small to be perceived thereby lack secondary qualities. Why not accept that, just as an atom has some size and shape, though we cannot detect them, since

8 I have left out of account the statement in Diogenes Laertius' summary of atomistic doctrine (**6** (44)) that the atoms were 'infinite in size and number.' 'Infinite in number' is unproblematic; we have good authority (see above) for the doctrine that there were infinitely many atoms. But 'infinite in size' is very puzzling. Diogenes might mean that (some) atoms are infinitely large, or that there is an infinite gradation of sizes among the atoms, or even, conceivably, that the total aggregate of atoms (i.e., the universe) is infinitely large. Whatever he meant, we have no idea what his source was. In view of the uncertainty both as regards meaning and as regards source, the evidential value of his statement is nil.

9 Nicholas Denyer has pointed out in discussion that elasticity at least does not in fact require the presence of void within the circumference of the elastic body. There is no incoherence in the conception that a given quantity of matter might expand so as to be continuously extended through a greater spatial volume, or contract so as to occupy a smaller volume (i.e., it might be spread more thinly or thickly, so to speak). It does, of course, require external void for the elastic body to expand into (unless we assume Cartesian vortices). Solubility would presumably be excluded as a special case of abrasion, which requires atoms to split.

the atom is too small to be perceived, so it has, for example, some colour and taste, which are undetectable for the same reason? This would not conflict with the requirement that colour is necessarily a visible property, and taste necessarily detectable by the sense of taste. The taste and colour of the atom, we might say, are de facto undetectable, as are those of things unobservable for other reasons than size, e.g., objects in distant galaxies. But they are in principle detectable, i.e., they would be observed under appropriate conditions, such as appropriate magnification. In any case, we saw that the evidence that all atoms are too small to be perceived was not wholly compelling. Suppose there are somewhere in the universe atoms big enough to be seen, and suppose we were in a position to see them (on the problematic nature of that assumption see below), then they would have to be seen as having some colour. And in that case, what ground could there be for denying that they actually do have some colour? The reasons for denying the ascription of secondary qualities to the atoms go deeper than the contingent fact that all the atoms which human beings encounter are too small to be perceived by human beings.

The crucial fact is indeed that secondary qualities are necessarily observable; to possess such a quality, e.g., colour, is to be such as to appear in a certain way to an observer equipped with the appropriate sensory apparatus. They are therefore essentially observer- or experience-relative; to ascribe them to anything is necessarily to ascribe to that thing the potentiality for a relation to a certain kind of sensitivity.[10] The atomists were among the earliest thinkers to grasp this central fact about secondary qualities, which they expressed in the assertion (**D16**) that the secondary qualities exist 'by convention.' Galen (**179d**) explains this claim as follows: 'By the expression "by convention" he [i.e., Democritus] means "conventionally" and "relative to us," not according to the nature of the things themselves, which he calls by contrast "reality," forming the term from "real" which means "true."'[11] Here we have the contrast between two levels of being

10 Cf. C. McGinn, *The Subjective View* (Oxford, 1983), p. 8: '[S]econdary qualities are subjective in the sense that experience enters into their analysis: to grasp the concept of red it is necessary to know what it is for something to look red, since this latter constitutes the satisfaction condition for an object's being red.'

11 Of the two expressions which Galen uses to gloss Democritus' *nomōi*, 'by convention,' the first, *nomisti*, is synonymous with Democritus' term, whereas 'relative to us' (*pros hēmas*) does not give a further synonym, but seeks to explain Democritus' usage. Words are applied *nomōi* when their application rests on convention or agreement, as opposed to being determined by the nature of the things to which they are applied. Galen is pointing out that, according to Democritus, agreement in the use of secondary quality terms is grounded in the regularity of the appearances which those qualities present to us. See n. 3 above on **D16.**

(mirrored in two modes of description), how things are in themselves, and how they appear to observers of a certain kind; atoms and the properties which we have so far seen ascribed to them belong to the former level (and their description in terms of those properties to the former mode), the secondary qualities to the latter (and descriptions in terms of them to the latter mode).

This raises the question why it should not be an intrinsic property of some things that they should be such as to appear in a certain way to certain kinds of observers. Here we need to be clear what we understand by the expression 'intrinsic property.' If an intrinsic property is simply one whose description requires no mention of any relation to an observer, then of course the conception of an observer-related intrinsic property is self-contradictory, and the question just raised is immediately answered. If, on the other hand, an intrinsic property is simply an essential property, i.e., a property which a thing of a given kind has in virtue of being a thing of that kind, the conception of an observer-related intrinsic property is not self-contradictory, since it may be intrinsic to things of a given kind to be related in certain ways to observers. Thus it is plausible to suggest that being observable, whether directly or indirectly, is an intrinsic property of any material object, in that every material object, in virtue of being a material object, has the causal power to affect a suitably constituted and suitably situated observer. On that conception of an intrinsic property, in which an intrinsic property is an essential property of a kind of thing, it remains to be answered why some secondary quality (or qualities) should not be an intrinsic property (or properties) of an atom.

Ultimately, the answer to that question is to be found in the atomists' theory of the nature of the secondary qualities, set out in the greatest detail by Theophrastus in his account of their theory of sense-perception (**113**). In essentials this theory describes the perception of any secondary quality as a response, not to the properties of an individual atom, but to a physical stimulus constituted by a continuous bombardment of a series of arrays of atoms. Thus visual perception, including the perception of colour, is a response to the impact on the visual organs of a continuous succession of films of atoms flowing from the surface of the perceived object (**119a–d**). For an object to be red, for example, is thus for it to emit films of atoms of such a nature that, when those films collide with an appropriately situated perceiver, the object will look red to that perceiver. Now what kind of atoms constitute films which prompt the perception of red? According to Theophrastus (75) the answer is 'large, round atoms.' The details do not matter; what is important is that the kind of atoms is specified in terms of size and shape (other sensible properties are referred to arrangement and orientation (73, 76)). It could not be satisfactory to answer the above

question by describing the perception of red as a response to a bombardment of films of *red* atoms. For given the above account of colour perception an atom is not the sort of thing that could itself be red, or any other colour. To have any colour C is to emit films of atoms such as to prompt a perceiver to perceive C, and no atom emits films of atoms.

Secondary qualities, therefore, are perceptible features of the macroscopic world, explained in terms of a theory of microscopic entities described, necessarily, without the ascription of secondary qualities. The point is not that to reintroduce the secondary qualities at the microscopic level would be to create reduplication in the theory; rather, the ascription of secondary qualities to the microscopic entities would require the radical revision of the theory, since the explanation of the secondary qualities in terms of microscopic entities, essential to the account of those qualities, would no longer be available when those qualities were applied to the microscopic entities themselves. Suppose, to take our previous example, that our theory explains redness as the emission of films of atoms of a certain kind, and also ascribes redness to the atoms themselves. Then either the atoms emit films from their surfaces, in which case they are no longer atoms, but aggregates, or else the account of redness has to be revised in such a way as to allow that a non-compound entity can be red. (The first option merely postpones the problem; if the original atoms are now aggregates, the theory has to deliver an account of the elements of which those aggregates are composed.)

An interesting consequence of this is that, at least as far as visibility is concerned, it is not the case that atoms are imperceptible because they are too small to be perceived. Since sight requires the stimulus of the perceiver by atomic films emitted by the seen object, an atom of whatever size would be invisible. But suppose an atom the size of, say, a cricket ball passes across my visual field ten feet in front of me. What do I see? Not the atom itself, for the reason just given. But on the other hand the atom is not transparent; it blocks off the atomic films from the objects behind it. It looks as though we should have to suppose that my visual field is incomplete; a temporary blind spot passes across it. At the blind spot itself, I should see nothing; that is to say, all that I could say about that area of the visual field would be 'It's as if something is obscuring that area; if you put something there I can't see it any more.' And if I were confronted with an atom big enough to blot out all but the edges of my visual field, it would be like having only peripheral vision.

It is therefore a necessary consequence of the atomistic account of the secondary qualities, not merely that secondary qualities are not among the causally significant properties of the atoms, but, more strongly, that atoms

have no secondary qualities. Colour, sound, taste, and smell are qualities of aggregates, not of single atoms. To ascribe one of those qualities to a subject is to describe that subject as so structured as to prompt a certain sensory response in a certain kind of perceiver; and 'so structured' is cashed out in a description of the underlying structure in terms of the intrinsic properties (shape and size) and relational properties (arrangement and orientation) of its constituent atoms. The persuasiveness or otherwise of the account of the secondary qualities cannot be separated from that of the whole theory of perception of which it is part, and that in turn from the theory of human nature, and ultimately of the natural world as a whole. As presented by the atomists, the theory is entirely speculative, since it posits as explanatory entities microscopic structures of whose existence and nature there could be no experimental confirmation. Modern developments in sciences such as neurophysiology have revised our conceptions of the structures underlying perceptual phenomena to such an extent that modern accounts would have been unrecognizable to Leucippus or Democritus; but the basic intuitions of ancient atomism, that appearances are to be explained at the level of the internal structure of the perceiver and of the perceived object, and that the ideal of science is to incorporate the description of those structures within the scope of a unified and quantitatively precise theory of the nature of matter in general, have stood the test of time.

Weight

A great deal of scholarly ink has been spilt on the question of whether the atoms of Leucippus and Democritus had weight. As with the question of divisibility, the problem arises from a conflict of testimony in our sources. While the great majority of sources agree in ascribing weight to the atoms, two passages of Aetius (**60a**, **b**) contradict this tradition. The former (followed by Eusebius *PE* XIV.14.5) states that while Democritus said that there were two primary properties of the atoms, Epicurus added a third, viz. weight; the latter says that Democritus denied that the primary bodies had weight, but said that they were moved by mutual impact in the void. On the other side the tradition is unanimous and clear. Aristotle asserts explicitly (**48a**) that 'Democritus says that each of the indivisibles is heavier in proportion to its greater size' and uses this feature of the theory to contrast atomism favourably with the theory of the *Timaeus*, according to which the primary physical elements are not solids but planes (**56**). The direct proportionality of atomic weight to size is confirmed by two passages of Theophrastus (**113** (61) and (71)). Simplicius reports (**61b**) that all atoms have weight, which is the cause of their movement through the void (**59b**:

see below). Alexander, believing, as we have seen, that the atoms were composed of parts which were themselves partless, finds in this view a difficulty for the theory, since he concludes that the partless components must be weightless and therefore that 'they [i.e., the atomists] do not even state the cause of weight in the atoms' (**46b**); i.e., he has no doubt that the atoms have weight, but believes that the theory cannot explain how they do, since it is committed to the absurdity that things with weight are composed of parts without weight. This agreement among our best sources is impressive, particularly since it is consistent with our prior knowledge of the theory. Atoms are, as we have seen, equally solid, in that none has any gaps. Hence they are equally dense, and so it is to be expected that, as in general for items of equal density, their weight would be directly proportional to their volume. (Like anyone else, a Greek would explain the fact that a large volume of wool is lighter than a smaller volume of iron by the lesser density of the wool (**56**), and would expect the larger of two lumps of iron to weigh more.)

Against such testimony the evidence of two passages of Aetius would have little force, were it necessary to make a straight choice, but in fact the context of the latter indicates an interpretation which tends to reconcile it with the Aristotelian evidence. In **60a** ps-Plutarch contrasts Democritus' account of the primary properties of the atoms as shape and size with that of Epicurus, who adds weight, giving the reason that 'it is necessary for the atoms to be moved by the blow of weight.' Here the context appears to be that of the description of atoms prior to the formation of worlds, or even of any aggregates; in that situation Democritus ascribes only shape and size to the atoms (presumably since arrangement and orientation presuppose the prior formation of aggregates). but Epicurus adds weight to account for the movement of the atoms. The reference is clearly to Epicurus' doctrine that prior to any impact with other atoms, the atoms moved continuously downwards in parallel straight lines through infinite space, this movement being explained by their weight (*Letter to Herodotus* 61, Lucretius II.217–18). The fifth-century atomists eschewed this precosmic introduction of a causal factor independent of impact, since they rejected the idea of original motion of the atoms prior to any atomic interactions. As we saw above (p. 163) the atoms were in an eternal state of random motion, every motion being the result of an infinite series of prior interactions. This contrast, between the Epicurean theory of original motion in a uniform direction caused by the weight of the atoms and the Democritean theory of random motion caused by prior interactions, is also sufficient to account for **60b** (Stobaeus), 'Democritus said that the primary bodies ... had no weight, but were moved by mutual impact in the void.'

It might seem that the statement that the primary bodies had no weight directly contradicts the Aristotelian evidence, and that the Stobaeus text must be convicted at least of loose expression. Instead of saying that the atoms had no weight, Stobaeus should have said that their precosmic movement was not explained by their weight. But in fact the most natural understanding of Stobaeus and the Aristotelian evidence renders them consistent while allowing the former to be literally true. Weight is a tendency downwards, and its ascription is therefore relative to a spatial frame of reference, provided for us, as for the ancients, by the earth; bodies fall towards the earth, and the weight of any body is measured by the force required to resist its free fall. In the atomists' precosmic universe these conditions were absent; no frame of reference allowed the identification of 'up' and 'down' in the infinite and symmetrical void (cf. **68**), nor did atoms have any tendency to move freely in any particular direction. Had the atoms all moved in parallel, as in Epicurus' precosmic universe, the direction of atomic motion could have been used to define 'down' simply as the direction of free atomic motion. But that would have been a signal violation of the Principle of Sufficient Reason; given that there was no antecedent reason for the atoms to move uniformly in one direction rather than another, the principle dictates that uniform motion should not occur, but either that atoms should move individually in all directions, or that no atom should move. It might seem that the principle requires the latter alternative, for if there is no reason for *an individual atom* to move in any direction rather than any other, how can it move at all? Yet motion is observed, hence the atoms must move. The difficulty is avoided by the abandonment of the conception of free motion altogether; there is always a reason for every individual atom to move in a particular direction, viz. that it is impelled in that direction by a prior atomic interaction. It is on precisely this point that Aristotle criticizes the atomists in **53**, complaining that the violent motion imposed by interaction presupposes a prior, natural motion of which the atomists give no account. In reply the atomists have merely to reject the presupposition; there is in fact no requirement that motion uncaused by interaction should be prior, either logically or temporally, to motion caused by interaction, and since there was no first interaction, but an infinite succession of interactions, the question 'What motion preceded the first atomic interaction?' poses no problem.

The reports in **60a** and **b** can then be taken to be literally true; in the precosmic situation the atoms have indeed no weight. The Aristotelian evidence, on the other hand, is most naturally read as describing atoms in the context of a cosmos. What kind of downward tendency do atoms evince in that context? Here again the evidence is relatively clear and

consistent. The fundamental cosmic process is the chance conglomeration, in the infinite welter of randomly moving atoms, of masses of atoms of all sizes, which gradually form rotating swirls or eddies (**D7**; **71c**, **74f**, **77**). (There is no indication that the atomists offered any explanation of why the primitive cosmic motion was rotary; perhaps they relied on observation of such phenomena as the formation of eddies in flowing water.) Within each eddy the atoms tended to move uniformly along the axis of rotation (i.e., to sink), but since the speed of this uniform motion was proportional to the size of the atom the larger atoms tended to congregate at the bottom and in the centre of the swirl, forcing the smaller atoms upwards and outwards to the periphery. The organization of the observable world manifests the resulting pattern, with the centre of the cosmic swirl occupied by the heavier elements of earth and water, which are composed of larger and therefore, as we may now say, heavier atoms, while the upper and peripheral areas are occupied by the lighter elements (composed of smaller and lighter atoms) of air and fire. The differentiations between the atoms of the various elemental masses are, however, relative only. All atoms have, within the cosmic swirl, a uniform centripetal tendency; the tendency of the smaller atoms to move upwards and outwards is explained, not by any inherent tendency in them, nor by centrifugal force, but purely as the effect of pressure from the faster-moving, larger atoms (**61a–b**). We thus have a neat reconciliation between the (bulk of the) Aristotelian evidence and that of ps-Plutarch and Stobaeus. As the latter report, in the precosmic situation the atoms are weightless, since they have no tendency to move in any direction rather than in any other. In the cosmic context, as Aristotle, Theophrastus, and Simplicius testify, all the atoms have weight, since all move towards the centre of the cosmic vortex (observed by us as motion towards the earth, i.e., motion downwards); and the larger they are the greater their weight, i.e., the greater the force required to resist their centripetal motion.

The above is a summary of the orthodox view of the evidence regarding the weight of the atoms. This view has, however, been challenged by D. O'Brien in his exhaustive study (O'Brien 40). O'Brien accepts the orthodox accounts both of the weight of the atoms within the cosmos and of their movement in the precosmic situation. He rejects, however, the inference drawn above that in the latter situation the atoms are weightless, arguing that whereas in the cosmos weight is a tendency to downward motion, in the precosmic situation weight has no connection with downward motion, but is expressed in speed of motion and force of impact. Central to his argument is **60b**, where Simplicius describes the atoms as moved by their weight through the void. It seems clear that this is indeed a description of the movement prior to the formation of aggregates, including cosmic

aggregates. We therefore seem to have the choice of accepting this passage as evidence that the atomists employed a concept of weight which had no connection with downward motion, or of concluding that Simplicius has here slipped into describing precosmic atoms in terms appropriate only to atoms within a cosmos. But here too a degree of reconciliation appears possible. We have seen that the evidence indicates that the motion of precosmic atoms was determined by antecedent interactions, and the outcome of each interaction must have been determined by the antecedent motions, shapes, and sizes of the colliding atoms. If we accept the conventional view, which has the almost unanimous support of the ancient sources, that these interactions were actual collisions,[12] it is plausible (though not directly attested) that the impact of a collision was thought to increase in proportion to the size of the impacting atom, not as a function of its extension, but as a function of its containing more matter. That is to say, it is plausible that the mass of an atom was conceived as a causal factor in atomic collisions, including precosmic collisions. If that is so, Simplicius' testimony that precosmic atoms were moved by their weight may be construed as a reference to this causal role of mass, while the apparently contrary evidence of ps-Plutarch and Stobaeus may be read as denying that precosmic atoms had weight as standardly conceived, i.e., as connoting a tendency to downward motion. The modification to the orthodox view thereby required is slight.[13]

D. Furley (Furley 29, chs. 7 and 8) also rejects the orthodox view, but for a different reason. He maintains that the centripetal tendency of atoms in the cosmic swirl cannot amount to their having weight, since the swirl will explain movement towards the central axis, but not the tendency to gather at the midpoint of the axis (i.e., the earth), which is what the ancients understood by weight. But D. Kostan shows convincingly (Kostan 33) that the complex dynamics of a vortex do explain the tendency of particles of different densities to collect at different heights in the vortex. In any case, what is required is not that the atomists should have had an

12 The contrary evidence of Philoponus and its implications are considered below under 'The Void.' If that view is correct, then impact has to be reconstrued as repulsive force, allowing the thesis considered here to be reconstrued as the thesis that the repulsive force of an atom increases in direct proportion to its mass.

13 Similarly Löbl 12 and 13 argues in favour of the attribution to the atoms of an inherent motive force, similar to Newton's conception of inertial mass, directly proportional to the amount of matter in the body, causing the atom to persist in uniform motion until deflected by external force. Löbl's view is, however, stronger than the thesis that the impact of atoms in collisions is directly proportional to their mass, in that he conceives this force as a source of motion intrinsic to the atom, a conception which is not required by that thesis. See below, pp. 194–5.

adequate explanation of this phenomenon, but simply that they should have observed it and attributed it, however, vaguely, to the action of the swirl. Rejecting that suggestion, Furley is obliged to conclude that 'weight, meaning a tendency to fall vertically, is a primary, irreducible property of the atoms' (Furley 29, p. 81), i.e., in that respect the theory of the atomists was identical with that of Epicurus. But that seems impossible to reconcile both with Aristotle's complaint that the atomists gave no account of the natural motion of the atoms, and with the doxographical evidence of the difference between the fifth-century atomists and Epicurus on this point (see above). That objection seems to me conclusive.

The Void

The atomists seem to have been the earliest thinkers to ascribe a theoretical role to the concept of the void. This role, which was determined by their program (see above) of reconciling the data of perception with the demands of Eleatic theory, was twofold: postulation of the void was required to accommodate (i) the motion and (ii) the separateness of the observable plurality of physical objects. But while our evidence makes it clear what the theoretical role of the void was, that same evidence makes it doubtful whether they arrived at a coherent conception of what it was that was posited to fill that role.

The twofold theoretical role is attested by Aristotle in **48a**; the Eleatics held that what there is is one and motionless, since (i) there could be no motion without a void into which the moving object could move (cf. *Physics* 213b12–14, Melissus DK 30 B7), (ii) there could not be many things if there were no void to separate them (Parmenides DK 28 B8.22–5), (iii) the void is what is not, (iv) what is not does not exist. But, the atomists pointed out, we observe a plurality of things, some of them in motion. What is it, then, which separates physical objects from one another, and into which physical objects move? The atomists' answer was simply 'nothing,' 'what is not' or 'the void,' which appear to have been interchangeable pieces of atomistic terminology (**44a**, **45**, **46a**; **44a** also attests the use of the term 'the infinite'). But now the theory seems explicitly self-contradictory: there is a void, but the void is simply what is not. So the atomists did not shrink from the conclusion that what is is no more than what is not (**46a**). Again, the assertion that what separates distinct objects is nothing leads straight to incoherence; either there is nothing which separates those objects from one another, in which case they are not separate from one another, or there is something which separates them, in which case 'nothing' is the name of something. How could the atomists meet these challenges?

While any attempt to reconstruct their thought must be speculative, we may suggest something along the following lines. There is indeed something which separates two non-adjacent objects, viz. an interval. But an interval is not any kind of *thing*; it is merely a gap, an absence of anything. So there are indeed gaps between objects, but gaps are nothings. And when an object moves, it moves into a gap. The statement of Themistius (**44d**) that Democritus said that the void was not-being and a privation might be taken as some confirmation of the atomists' having thought in that way. But that can hardly be the whole story. For the notion of an interval or a gap presupposes a continuous dimension in which the objects and the interval between them are alike situated; for two objects to be separated by a gap, whether spatial or temporal, is for them to be at a distance from one another in space or time, which presupposes a system of measurement applying alike to the gap itself and to the objects whose extremities bound it. That is to say, the atomists' conception of the void cannot have been merely that of the non-being of a physical object; it was at least that of a gap in space, where space is conceived, however inchoately, as a continuous dimension. Here we should also take account of the atomists' claim that the void is infinite in extent, and their use of the term 'the infinite' as a designation of it (**44a**). This evidence is most naturally read as asserting that empty space is itself unbounded, i.e., of infinite extent. We may then attribute to the atomists the view that the universe consists of an infinitely large collection of indivisible physical objects moving in infinite space, where space is a three-dimensional continuum of which any part may be either occupied by an atom or unoccupied. On that conception 'the void' is simply the designation of any extent of space which happens not to be occupied by an atom; that might explain the thought that the void is not something real, since the designation of the term will change from one moment to another (cf. 'the uninhabited'). But it would then need to be explained why the atomists spoke of atoms and the void, rather than of atoms and space. Further, did their attempted reply to the Eleatics commit them to the view that space itself is unreal?

On the first point it may be suggested that whereas 'full' and 'empty' are terms which derive their sense from such simple observations as that of a bucket alternately filled and emptied, 'space,' understood as a three-dimensional continuum any part of which may be either full or empty, is a concept which requires a higher level of abstraction.[14] Of course, if the ultimate constituents of reality are designated by the expressions 'the

14 See Sedley 41.

full' and 'the empty,' the abstract concept is required to specify what it is which is full or empty. But it is not implausible to suggest that the atomists had not attained that level of abstraction, and were thus using the term 'the empty' in undifferentiated application to *unoccupied* space and to space as such. On the second point, assuming that undifferentiated use, it is hard to see how the atomists can be defended against the charge of inconsistency, since on the one hand their response to the Eleatics involved the assertion that 'the empty' is what is not, while on the other their account of secondary qualities (see above) contrasted those qualities with what exists *eteēi* (in reality), i.e., atoms *and the void* (**D16**). Once again, we can suggest certain moves which the atomists might have made to preserve consistency. The account of secondary qualities contrasts what is essentially observer-dependent with what is not so dependent; space is assigned to the latter category, since it is not itself a disposition to evoke a certain kind of sensory response in a suitably equipped percipient, but a theoretical postulate required for the explanation of the existence of that kind of disposition. On the other hand, it might be urged, space is not any kind of substance, as atoms are, but is merely the place where substances are or may be.[15] Place is not an entity in its own right; rather its existence is entirely derivative from that of the substances which are in it. Yet the content of the latter claim is far from clear. If the claim is that space has no properties of its own, the properties of any space being simply those of any body which does or might occupy it, it does not appear to be true. The property of extending to infinity in three dimensions appears to apply to space immediately, not in virtue of applying to any actual or possible body, while the property of being capable of being occupied by a body is a property of space which is not a property of any body. A more readily defensible claim would be that there is no absolute space, space being merely an idealized system of relations between actual objects. It should be emphasized that we cannot claim that that was the atomists' actual view of space. The most that can be said is that it gives us a way of reconciling the atomists' response to the Eleatics with their claim (**D16**, **46a**, **58a**) that the void is one of the principles of reality.

The theoretical role of the void in accounting for the separation of atoms from one another has an interesting implication, recorded by Philoponus (**54c–e**). Since atoms are separated from one another by the void, they can never, strictly speaking, come into contact with one another. For if they did, even momentarily, there would be nothing separating them from

15 Cf. Theodoretus *Cure for the Ills of the Greeks* IV.9.14 (cited in **58**): 'Democritus and his followers called the void the place of the atoms.'

one another. But then they would be as inseparable from one another as the inseparable parts of a single atom, whose indivisibility is attributed to the lack of void in it (see above); indeed, the two former atoms would now be parts of a single larger atom. But, as we saw, the atomists held it to be absurd that two things should become one (**44a**). Holding atomic fusion to be theoretically impossible, and taking it that any case of contact between atoms would be a case of fusion (since only the intervening void prevents fusion), they perhaps drew the conclusion that contact itself was theoretically impossible. Hence what appears to be impact is in fact action at an extremely short distance; rather than actually banging into one another, atoms have to be conceived as repelling one another by some sort of force transmitted through the void. Again, though no source directly attests this, the interlocking of atoms which is the fundamental principle of the formation of aggregates is not, strictly speaking, interlocking, since the principle of no contact between atoms forbids interlocking as much as impact. Just as impact has to be reconstrued as something like magnetic repulsion, so interlocking has to be reconstrued as quasi-magnetic attraction.[16] If this suggestion is correct (and it is fair to point out that no ancient source other than Philoponus supports it) it is a striking fact that, whereas the post-Renascence corpuscular philosophy which developed from Greek atomism tended to take the impossibility of action at a distance as an axiom,[17] the original form of the theory contained the a priori thesis that all action is action at a distance, and consequently that impact, so far from giving us our most fundamental conception of physical interaction, is itself a mere appearance which disappears from the world when the description of reality is pursued with full rigour.[18]

Clearly the argument 'Atoms in contact are physically continuous with one another; but physically continuous things are inseparable (**44c**);

16 See Klein and Matheson 32, discussed by Godfrey 30.

17 E.g., Newton to Bentley, cited by H.S. Thayer ed., *Newton's Philosophy of Nature* (New York, 1953), p. 54: 'That gravity should be so innate, inherent and essential to matter, so that one body may act a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it.'

18 Bodnár 43 mounts a strong challenge against accepting Philoponus' evidence as preserving the actual view of the atomists. He argues that the silence of all other authorities, above all of Aristotle, on such a crucial point would be inexplicable had the atomists actually denied atomic contact, and suggests that, rather than reporting an actual view, Philoponus should be seen as inferring what the atomists ought to have said to escape the theoretical difficulty posed by contact between atoms.

therefore, atoms in contact are inseparable' is valid. Hence anyone who rejects the conclusion must attack one of the premisses. The obvious target is the second premiss. Numerically distinct things may yet be physically continuous, in that they are in contact, without being inseparable, i.e., without being incapable of moving apart from one another. That is to say, physical contact is not sufficient for physical fusion. But the theory now has to explain why that is so, and for that task its resources are inadequate. Since absence of void is the sole explanation of physical indivisibility (see above), the theory cannot explain why the parts of a single atom cannot separate, whereas two atoms in contact can. Given that explanation of indivisibility, the atomists would have been quite correct to conclude (whether or not they did in fact so conclude) that atomic contact was impossible. The counter-intuitive character of that thesis is a symptom of the weakness of that explanation. Here the theory runs into difficulties by trying to make the concept of void do too much work; the distinction between a single continuous object (e.g., a marble sphere) and a geometrically similar pair of objects (e.g., a pair of perfectly fitting marble hemispheres) cannot be made by positing a void present in the latter case but not in the former, but must take the internal cohesion of a unitary basic material object for granted.

Chance and Necessity

While the broad outlines of the views of the atomists on these topics can be fairly readily reconstructed, there is much obscurity about the details. The atomists' universe is purposeless, mechanistic, and deterministic; every event has a cause, and causes necessitate their effects. Broadly speaking the process is mechanical; ultimately, everything in the world happens as a result of atomic interaction. The process of atomic interaction has neither beginning nor end, and any particular stage of that process is causally necessitated by a preceding stage. But exactly how the atomists saw the process as operating is obscure. This obscurity is largely attributable to the fragmentary nature of the evidence which we possess, but it may be that the statement of the theory itself was not altogether free from obscurity.

The fundamental text is the single fragment of Leucippus (**L1**), 'Nothing happens in vain, but everything from reason and by necessity.' The denial that anything happens 'in vain' (*matēn*) might well be taken in isolation to amount to an assertion that all natural events are purposive, since the adverb and its cognates frequently have the sense 'not in accordance with one's purpose' or 'pointlessly.' If that were the sense of 'not *matēn*,'

then 'from reason' (*ek logou*) would most naturally be understood as 'for a purpose.' These renderings are, however, very unlikely. The majority of the sources (**73–5, 208**) follow Aristotle (**74a**) in reporting that Democritus denied purposiveness in the natural world, explaining everything by mechanistic 'necessity.'[19] A reading of Leucippus which has him assert, not merely (contra Democritus) that some, but that all natural events are purposive, posits a dislocation between the fundamental world-views of the two of such magnitude that we should expect it to have left some trace in the tradition. Moreover, the attribution of all events to necessity, a central feature of the mechanistic Democritean world-view, is itself attested in the fragment of Leucippus. We ought, then, to look for an interpretation of the fragment which allows it to be consistent with Democritus' denial of final causation.

Such an interpretation is available without forcing the texts. Sometimes (e.g., Herodotus VII.103.2, Plato *Theaetetus* 189d) *matēn* is to be rendered not 'without purpose' but 'without reason' ('in vain' and 'empty' have similar ranges of application). Given that construal of *matēn*, 'from reason' is to be construed as 'for a reason,' where the conception of reason is linked to that of rational explanation. The first part of the fragment ('Nothing happens in vain, but everything from reason') thus asserts, not universal purposiveness in nature, but a principle which we have already seen to be pervasive in atomism, the Principle of Sufficient Reason. Instead of a radical discontinuity between Leucippus and Democritus, the fragment, thus construed, attests commitment to a principle basic to atomism. The second half ('and by necessity') makes a stronger claim, which links the notion of rational explanation to the notions of necessity and of cause. The stronger claim is that whatever happens *has to* happen, cannot but happen. This amounts to a specification of the reason whose existence is asserted in the first half of the sentence; nothing happens without a reason,

19 An apparent exception is **74d** (from ps-Plutarch and Stobaeus). After ascribing to Democritus (and Parmenides) the doctrine that everything is according to necessity, the citation continues 'and the same is fate and justice and providence and the creator.' The reference of 'the same' (*tēn autēn*) is presumably the feminine noun *anangkē*; Democritus is therefore said to have identified necessity with fate, justice, providence, and the creator. Apart from the authority of this testimony, its meaning is problematic. It might be taken (in opposition to all the other evidence) as ascribing purpose and moral content to necessity, but could as well be taken as explaining justice and providence away as nothing more than necessity, i.e., as saying 'necessity is what (so-called) fate, justice, and cosmic providence really are.' Since in the next section ps-Plutarch cites Democritus' mechanistic account of necessity as impact (**74e**), consistency is better preserved by the latter reading.

and, in the case of everything which happens, the reason for which it happened was that it had to happen. But the claim that whatever happens happens 'by necessity' is not *just* the claim that whatever happens has to happen, though the former implies the latter. For the concept of necessity is not a purely modal concept requiring elucidation via its connection with other such concepts, such as possibility and impossibility. Rather, necessity is conceived as an irresistible force bringing it about that things have to happen. This is indicated both by the causal force of the preposition *hupo* (rendered 'by' in the expression 'by necessity'), and also by the fact that Democritus is reported as *identifying* necessity with impact and motion (**74e**; on the interpretation of this see below). Impact and motion, then, take over the determining role traditionally assigned to Necessity, when the latter is conceived (as in Parmenides and Empedocles) as an ineluctable, divine cosmic force (cf. Plato, *Protagoras* 345d5 'Against necessity not even the gods fight').[20]

Nothing, then, just happens; every event occurs because it had to occur, i.e., because it was made to occur by prior interaction of atoms with one another and prior motion of atoms. So there can be no purely chance events, i.e., no events which simply happen. Democritus may have drawn this conclusion; **71a–b** are evidence of his having maintained that all events have determinate causes, and hence that nothing comes about by chance. On the other hand, we have evidence that the atomists assigned some role to chance in the causation of events, though precisely what role is not easy to determine. Aristotle (**71a**), Simplicius (**71b–c**), and Themistius (**71d**) all say that Democritus attributed the formation of every primal cosmic swirl to chance (indeed Aristotle finds a special absurdity in the theory that while events in a cosmos occur in regular causal sequences, the cosmos itself comes into being purely by chance). Cicero (*De Natura Deorum* I.24.66, cited under **58**) says that heaven and earth come into existence 'without any compulsion of nature, but by their [i.e., the atoms'] chance concurrence,' while Lactantius (**73**) baldly attributes to Democritus and Epicurus the view that 'everything happens or comes about fortuitously.' **72** (from Theorodetus) may be read either as asserting or as denying that Democritus believed that there are genuinely chance events. Read in the latter way it attributes to Democritus the view that we explain an event as due to chance when its real cause is unknown; on the former reading the view attributed to Democritus is that chance is itself a real cause of events,

20 Barnes 24 concludes his admirably lucid and learned discussion of the fragment by suspending judgment between the interpretation defended here and that which attributes to Leucippus the thesis of universal teleology.

but an unfathomable one (the position mentioned by Aristotle without attribution at *Physics* 196b5–7). A passage from Epicurus' *On Nature* (**208**), which one might hope to be our most authoritative source, is similarly ambiguous. There Epicurus describes the atomists as 'making necessity and chance responsible for everything,' a formulation which is ambiguous between two positions, (i) 'necessity' and 'chance' are two names for a single universal cause, (ii) necessity and chance are distinct but jointly exhaustive causes of everything.[21]

73 is of little weight; Lactantius states that the fundamental question is whether the world is governed by providence or whether everything happens by chance, and says that Epicurus and Democritus held the latter view. It is plausible that he took their denial of providence to commit them to that view, since he himself took those alternatives to be exhaustive. This passage, then, gives no independent ground for the attribution to either philosopher of the thesis that literally everything happens by chance.

We are still, however, left with those passages attesting Democritus' belief that every cosmic swirl, and therefore every cosmos, comes into being by chance. That might be thought to be confirmed by the statement in Diogenes Laertius' summary of Democritus' cosmology that he identified the cosmic swirl itself with necessity (**6.44**; cf. **74f**). On this interpretation the statement that everything happens by necessity is confined to events within a cosmos, and states that all such events are determined by the atomic motions constituting the swirl. The swirl itself, however, is not determined by itself, or by anything; it just happens. Dionysius ap. Eusebius (**63a**) also reports Democritus as ascribing the formation of worlds to chance, and goes further by reporting him as holding that the precosmic motion of the atoms was also random ('these atoms travel in the void *hōs etuchen* [lit. 'as it chanced']'; cf. **79a**, from ps-Plutarch's epitome). On this view necessity governs, but is local to, a world order, which itself arises by chance from a precosmic state where there is no necessity.

The recognition of pure chance is, however, inconsistent with the Principle of Sufficient Reason, which we know the atomists accepted. It therefore seems preferable to look for some interpretation of the evidence which is consistent with that principle. That interpretation is provided by the first reading of the Theodoretus passage (**72**), viz. that the ascription of events to chance is a confession of ignorance of their causes, not a

21 In Epicurus' own theory, chance and necessity are distinct causes (*Letter to Menoeceus* 133 [= Diogenes Laertius X.133]), so if he is assuming that the atomists share his view, the position he ascribes to them is ii. But that assumption is not required by the text, which leaves open the possibility that the view ascribed is i.

denial that they have causes. Some features of the evidence support this suggestion. Diogenes' summary of the cosmology of Leucippus (**77a**) concludes with the sentence 'Just like the coming into being of worlds, so do their growth, decay, and destruction occur according to a certain necessity, the nature of which he does not explain' (cf. Hippolytus, **78**). In line with his famous dictum, then, Leucippus held that all events including the formation of worlds happen according to necessity, but was unable to say what it is that necessitates cosmic events. It is then plausible that either he himself or Democritus said that such events may *be said* to occur by chance, in the sense that we are (whether merely in fact or in principle is indeterminate) ignorant of their causes. Simplicius' evidence suggests just that; in **71c** his attribution to Democritus of the view that the cosmic swirl arises by chance is avowedly his own inference from the fact that Democritus did *not* say how or why that occurs. In **71b** he says that although Democritus appeared (*edokei*) to have made use of chance in his account of the formation of worlds, in his more detailed discussions (*en tois merikōterois*) he says that chance is not the cause of anything. That suggests that he merely seemed to ascribe cosmogony to chance (perhaps by speaking of it as a chance occurrence in the sense of an occurrence whose cause is unknown). Explanations of specific kinds of events and of particular events were governed by the principle that there are no chance events, but no attempt was made to offer explanations of the fundamental cosmic processes themselves. That need not imply that they are literally uncaused, but that they might as well be treated as such, since their actual causes are of a degree of complexity outstripping the powers of the human mind to discover.

For the atomists, then, everything happens of necessity; the identification of necessity with the mechanical forces of impact and motion may have been due to Democritus. But what exactly was his view on this? **74e** (from ps-Plutarch's epitome) reports him as identifying necessity with 'impact and motion and a blow of matter.' Are impact and motion given equal status in this identification, or is it taken for granted that motion is always caused by prior impact? On the former construal some motion may be either uncaused, or attributable to a cause other than impact. In favour of the first alternative is Aristotle's evidence in **69a–b** that Democritus held that one should not ask for a cause of what is always the case. He might then have said that the atoms are simply always in motion. But while that principle allows him to exclude the question 'What causes the atoms to be in motion?' the Principle of Sufficient Reason requires that the question 'Why is any particular atom moving with any particular motion?' should have an answer, and it might appear inevitable that that answer should refer

to a prior atomic collision. We have, however, to recall the evidence from Philoponus that atoms never actually collide or come into contact, with its implication that the basic physical forces are attraction and repulsion. Attraction, as we saw, explains, not atomic motion, but the immobility of atoms relative to one another, since the relative stability of atoms in an aggregate has to be explained, not by their literal interlocking, but by their being held together *as if* interlocked by an attractive force operating over the tiny gaps between the atoms in the aggregate. But some form of attraction may also have explained some atomic motions; Sextus cites Democritus (**D6**) as holding that things of the same kind tend to congregate together, and as illustrating that by examples of the behaviour of animate (birds flocking together) and inanimate things (grains of different sorts being separated out by the action of a sieve, pebbles of different shapes being sorted together by the action of waves on a beach). That this principle was applied to the atoms appears from Diogenes' account of the cosmogony of Leucippus (**77a**), where atoms of all shapes form a swirling mass from which they are then separated out 'like to like' (cf. **78** (Hippolytus) 'when many bodies are collected out of the surroundings and flow together into a great void, in their collisions those of the same and similar shapes get entangled'). The separation out of atoms of different *sizes* could adequately be accounted for by the stronger centripetal tendency of the larger, itself a function of their greater mass (see above). But the context in Diogenes, where the atoms have just been described as of all shapes, with no mention so far of size, suggests that 'like to like' is here to be understood as 'like to like in shape.' Ps-Plutarch's report of Democritus' account of sound (**124**) asserts that atoms of like shape congregate together, and contains the same illustrative examples as the Sextus passage; it is plausible, though not explicitly asserted, that this same principle accounts for the formation of aggregates of spherical atoms, e.g., flames and souls. While that is conjectural, we have explicit evidence that the attraction to one another of atoms of the same shape was part of the atomistic explanation of magnetism (**160**), while **103** attributes the saltiness of the sea to the operation of the 'like to like' principle.[22] Simplicius explains the formation of atomic aggregates (**45**) in part by the principle that it is natural for things of the same kind to move towards one another; while the reference is not specifically to likeness of shape, it certainly includes it, and gives us clear evidence of the postulation of some principle of attraction among the fundamental principles of atomism.

22 See further Müller 37.

Some other aspects of atomic motion make an awkward fit with the hypothesis that all atomic motion results from prior collision. Simplicius' quotation from Aristotle's *On Democritus* (**44a**) includes the statement that the atoms 'conflict with one another [*stasiazein*] and travel about in the void because of their unlikeness and the other differences which have been mentioned'; the only differences cited in the passage are those of shape and size. 'Conflict with one another' looks like a quasi-metaphorical reference to the chaotic character of the original atomic motion, likened to the confusion produced by political conflict (*stasis*) in a state,[23] which leaves open the question of what causes that confused motion. But what is the force of 'because of their unlikeness'? *Prima facie* that looks unlikely to be another way of expressing 'because of their mutual impact,' and it is at least tempting to postulate a principle of the repulsion of unlikes from one another as a counterpart to the 'like to like' principle. While it is clearly illegitimate to base an ambitious structure of speculation on a single phrase, there is another form of atomic motion which sits uneasily with a pure impact theory, viz. the incessant efflux of films of atoms from the surfaces of all atomic aggregates (**113** (50), registered in thought and perception as images [*eidōla*]).[24] Are these films shaken off the surfaces of the aggregates under the continuous impact of atoms colliding with the aggregate? Possibly; but why should that impact produce a continuous flow of films preserving the form of the aggregate, rather than, as might be expected, an efflux of single atoms or of clusters of atoms? We should at least consider the alternative possibilities that the atomic films are repelled by other atoms in the aggregate, or that they are attracted by atoms external to the aggregate, or finally that they have an internal source of mobility.[25]

We have, then, some evidence that Democritus' dynamics postulated three fundamental forces, a repulsive force which plays the role of impact in a conventional corpuscular theory and two kinds of attractive force, one which draws together atoms of the same shape and another which holds together atoms of different shapes in an atomic aggregate. There is also some rather vague evidence to suggest that atoms may have been conceived as having an internal source of mobility.[26] It is plausible that Democritus

23 See LSJ s.v. *stasiazō*.

24 See Hirsch 31.

25 See n. 13 above, p. 183.

26 Besides this rather sketchy evidence of attractive and repulsive forces in atoms, there is even a hint in **67b** that Democritus might have attributed some causal power to the void, with which one might wish to connect Plutarch's attribution to him (**178c**) of the assertion that the void has a nature and substance of its own. I suspect that Democritus' view was merely that the existence of the void is a necessary condition of change, in that

applied the term 'necessity' to all these forces, regarding them alike as irresistible. It must, however, be acknowledged first that the evidence for this theory is fragmentary, and secondly that, even if that evidence is accepted, we have no idea whether or how Democritus attempted to integrate those forces into a unified theory. Stated thus baldly, the theory has obvious difficulties, e.g., if two atoms of the same shape collide, do they rebound or stick together? If all atoms have both attractive and repulsive force there must be some yet more basic principles determining which force or combination of forces determines their motion. Our sources give no hint of whether Democritus had so much as considered these questions.

SCIENCE AND MATHEMATICS

The catalogue of Democritus' works (**40**) includes an encyclopedic range of titles in what would now be called the natural sciences, and the doxography preserves reports of his views on a wide variety of questions in astronomy, meteorology, geography, biology, etc. The heterogeneous nature of this material makes it difficult to form a judgment of how systematic Democritus attempted to be in his 'scientific' work. Some reports – e.g., **100** (on wind), **158** (on why metal plates float on water), **160** (on magnets) and **162** (on why some things are more readily heated than others) – attest the application of the atomic theory to the explanation of particular phenomena, while many show no trace of the theory whatever. Of the latter some merely record observations, while others offer speculative interpretations and explanations without overt atomistic content. In part this reflects the fragmentary character of the evidence; a random scattering of reports of Aristotle's works on nature would be likely to present the same unsystematic appearance. It is, however, necessary to take seriously the possibility that Democritus' work in this area was less than totally systematic, in the sense of attempting to provide, via the postulates of atomism, a unified account of all the phenomena which he considered. The fundamentals of the theory might have had a looser relation to the detail, by way of setting limits on acceptable explanations, such as the refusal to countenance teleology, or to postulate immaterial substances.

The astronomy of the atomists is best seen as descriptive of the world-order whose formation and basic structure is explained by the atomic theory. The outline is given in the reports of Diogenes Laertius, Hippolytus, and Aetius

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change is brought about ultimately by motion, which requires void. Eudemus will then have interpreted him unsympathetically in challenging him on whether the void is an Aristotelian efficient cause.

(**77–9**) of the atomists' cosmogony: the basic (unexplained) process is the formation of circular eddies of atoms in the primitive atomic chaos (**77a**). Within each eddy the larger atoms move towards the centre, where they form a rotating circular mass (the earth), while the smaller are forced out to the periphery, where they form a spherical membrane which is heated by its motion (perhaps through friction with atoms outside, though that is not explicitly stated) to the point where it catches fire. This gives the basic picture of a geocentric cosmos, with a flat rotating earth in the centre, surrounded by the fiery heavens. The detailed description of this cosmos, in terms of the differentiation of the various heavenly bodies, their motions, and their relative distances from the earth, is the task of astronomy. Such detail as survives has little or no atomistic content, but no doubt presupposes the atomist account of macroscopic physical bodies. The heavenly bodies are masses of stone or earth (**83a**), white-hot as a result of their motion (**86a**, **89**), while their apparent motions are explained by the fundamental circular motion of the cosmos, given which the bodies nearer the centre of the swirl (sun, moon, and planets) move more slowly than the fixed stars at the periphery (**87**). According to Diogenes (**77a** (33)), Leucippus had held that the sun was at the periphery of the cosmos and the stars nearer to the earth, while ps-Plutarch attributes the opposite view to Democritus (**84**). While we lack evidence as to the grounds which led to this change of view, it is tempting to suppose that the decisive factor was the better fit of the latter picture with observation, rather than any attempt at derivation from the postulates of atomism. On the other hand, the stability of the earth at the centre was explained, according to Aristotle (**99a**), by the resistance of the air beneath it, a phenomenon which was in turn explained by the impact of the atoms composing the air (**158**), or according to Philoponus (**99b**) by the centrifugal force of the cosmic swirl; either way we have recourse to primary postulates of the theory.[27] Phenomena such as earthquakes (**101**) and the Nile flood (**102**) are explained indirectly, by appeal to macroscopic processes, wind, the flow of water, condensation, etc., which are themselves explicable in more fundamental terms (see **100** for one such instance).

27 While the accounts of Aristotle and Philoponus assimilate the atomists' explanation to that of Anaximenes, ps-Plutarch (**99c**) assimilates it to Anaximander, in attributing the stability of the earth to the Principle of Sufficient Reason; since the earth is at the centre of the cosmos there is no reason for it to move one way rather than another. While that principle was used by the atomists (see above), it is more likely that ps-Plutarch is incorrect in citing it in this context than that Aristotle was completely wrong in identifying the atomists' explanation.

A notable feature of atomistic cosmology is the absence of any privileged status for the human race or the world which it inhabits. Though the earth is at the centre of our world, that world is merely one of an infinite number of worlds (**80**) which come into and go out of existence in endless sequence throughout a universe infinite in space and time (**80b–c**). There are worlds of a great many different kinds, only some of which contain living beings (**78**). Given that the atomists appealed to the Principle of Sufficient Reason for the thesis that there are infinitely many worlds (**80c**), it is at least plausible that they also argued that on the same ground there must be worlds of every possible kind (with the implication that human or human-like beings exist only in a tiny proportion of them). Worlds are described in biological terms as growing, coming to maturity, and decaying (**77a**, **78**), the process of decay being explained by loss of the ability to assimilate external material (**78**), an obvious analogue of the process of nourishment. Another feature suggestive of a biological conception of cosmogony is the growth round the developing cosmos of a skin or membrane (*humēn*) similar to that surrounding an embryo (**77a–b**). The use of these terms indicates not so much a vitalistic conception of cosmogony as the continuity in atomistic theory between the organic and the inorganic. Worlds can literally be thought of as large-scale organisms, since organisms are nothing but highly complex arrangements of atoms, whose pattern of development and decay is ultimately attributable to the necessity constituted by the behaviour of the atoms (see above).

The evidence about Democritus' writings on biology itself (testimony relating to Leucippus in this area is particularly sparse, see **138d**, Aetius V.4.1 (cited in **135**)) testifies to their diversity. He was clearly interested in a very wide variety of plants and animals, including insects (**142**), grubs and caterpillars (**151**), and spiders (**144**), where he gave the correct account of how they spin their webs, in opposition to Aristotle's. (It would be pleasing to attribute this to better observation, but for all we know it might have been a lucky guess.) Once again, some of the explanatory passages show some traces of atomic theory; the growth of horns in some animals and lack of them in others is explained by a hydraulic theory in which material absorbed in food flows to the head and thence outwards to a degree determined by the dimensions of the channels carrying the liquid and by the relative density or porosity of the skull, all features which ultimately depend on the atomic constitution of the part of the body concerned (**145** (18), (20)). A similar hydraulic explanation was given of the growth of plants (**156**). But most of the views attributed are not specific to atomism, though not incompatible with it. The belief that animal (including human) life was originally generated from primeval slime (**154a–c**) is common to many early cosmologies, including those of Anaximander (DK 12 A11, A30), Archelaus

(DK 60 A1), and the source of the cosmogony in Diodorus I.7 (printed by DK with 68 B5). Similarly the doctrine that plants have some kind of mind is a view which Democritus shared with Empedocles, Protagoras, and Plato (**155a–b**; cf. DK 31 B110.10 (Empedocles), Plato *Timaeus* 77a, *Theaetetus* 167b–c, the latter passage purporting to represent the views of Protagoras). One can readily see that the view that mentality is determined by the presence of soul-atoms (see below, under 'Psychology') would naturally lead Democritus to the conclusion that some of those atoms must be found in plants (and perhaps even in stones, if **161** is taken as some garbled reflection of atomistic doctrine), but we have no specific evidence on the point.

The subject on which Democritus' views are most fully reported is embryology, largely because Aristotle, who took an opposed position, refers critically to them in a number of places. Democritus held the theory, also found in some of the Hippocratic treatises (especially *On Generation*), that both parents contribute semen (**138a–d**), that the character, including the sex, of the foetus is determined by which parent's semen 'predominates'[28] (ibid.), and that semen issues from all parts of the body (**136**; **D8–9**). The latter doctrine is presumably an attempt to explain how the structure of the parents comes to be reproduced in the offspring, and can readily be interpreted in atomistic terms (though, as its presence in the Hippocratic writings attests, it does not presuppose atomism or any other theory of the nature of matter). The atomistic version was presumably that the atomic structure of each of the organs and other bodily parts of the parent was reproduced in the semen and was therefore already present in the foetus as a structural basis for its development. That is to say, as opposed to the Aristotelian view in which the semen was purely a vehicle via which the male mysteriously imposed the form of the species on the unstructured material (menstrual blood) provided by the female, the Democritean theory attempts to explain how the material is inherently structured. The doctrine that semen is drawn from the whole body allows Democritus to answer Aristotle's objection (**138b**) that it is impossible on that theory to explain how an offspring can resemble the parent of the opposite sex more than the parent of its own sex. If, say, a blue-eyed father and a brown-eyed mother have a blue-eyed daughter, the explanation is that the father contributed more eye-atoms and the mother more genital-atoms. A more difficult task for the theory would be to explain how the miniature structures laid down

28 It is likely (*pace* de Ley 73) that 'predominating' is to be understood quantitatively, as is clearly the case in the Hippocratic *On Generation* 6 and 8. In **138a** and **d** the terminology is ambiguous (*kratein* in **138a**, *epikrateia* in **138d**), but in **138d** unambiguously quantitative.

in the semen determine the course of future development. Given that the theory had to explain growth and development in terms of the formation of bigger and bigger atomic aggregates, what could guarantee that the later aggregates would continue to reproduce the shape of the earlier? Here the atomists' resolute refusal to admit any element of teleology (cf. **141**) created severe difficulties, since, lacking such an element, the purely mechanical principles of aggregation which were all that the theory provided are insufficient to give an account of a genetic program.[29]

As far as mathematics is concerned, the list of titles shows that Democritus was active in the main areas of the mathematics of the time, geometry (including projective geometry), arithmetic, and the theory of irrationals. In **165** Archimedes reports significant discoveries in solid geometry, anticipating later proofs. The first of the recorded book titles is 'On difference of judgment, or on the contact of circle and sphere.' Some scholars have emended 'judgment' (*gnōmē*) to produce a more specifically geometrical title, e.g., 'On a difference of a *gnōmōn*' (Cobet) or 'On a difference in an angle' (*gōniēs*, Heath). It is, however, worth recalling Democritus' distinction (**D22**) between the two sorts of *gnōmē*, the 'bastard' judgment provided by the senses and the 'genuine' or 'legitimate' judgment provided by the intellect (see below, under 'Epistemology'). It is at least tempting to suggest that his discussion of the contact between circle and sphere might have had something to do with that distinction, e.g., by showing that sense perception will always misrepresent the contact between the two figures as coincidence over a stretch instead of at a point, as Protagoras observed in the case of the tangent of a circle (DK 80 B7).[30] If that is so, then the book will have dealt with the sort of issues exemplified by the famous 'cone problem' (**164**). Plutarch merely reports the dilemma which Democritus posed, with no indication of whether he proposed a solution. One question which the report raises is whether he distinguished between a physical cone of wood or bronze and the mathematical object. Perhaps the point of the puzzle was to make that very distinction. In that case Democritus may have sought to show that what appears to the senses (i.e., to *skotiē gnōmē*) as a smooth cone is in physical reality a stepped pyramid (as *gnēsiē gnōmē* reveals). Or

29 See Hirsch 31. For fuller discussion of Democritus' embryology and its connections with the Hippocratic Corpus see Salem 15, ch. 5.

30 In the light of the discussion of Philoponus' claim that the atomists denied atomic contact (see above). it would be even more tempting to speculate that *gnēsiē gnōmē* revealed that a (physical) circle could not touch a physical sphere at all. But that would be to carry speculation too far.

perhaps the aim was to distinguish, not between mathematical and physical objects, but between mathematical and physical division of any object. In that case Democritus may have sought to show that while mathematically a cone can be divided into an infinite number of infinitely thin slices, the top surface of each slice being of infinitesimally smaller diameter than the bottom surface, physical division cannot proceed ad infinitum. Or again, if he made no distinction between physical and mathematical divisibility (see above, 'Divisibility') he may have used the puzzle to try to show that both are theoretically impossible. The disappointing outcome is that consideration of the cone problem does not help to resolve the problem which is posed by direct consideration of the indivisibility of the atoms, since precisely that problem is raised again by the cone problem itself.

PSYCHOLOGY

To the extent that the term 'psychology' means 'a theory of the nature of the mind,' the application of the term to the atomists runs the risk of anachronism, since examination of the evidence grouped above under that heading indicates how problematic it is to ascribe to the atomists anything which could be called a *theory* of the mind. We must guard against over-statement here. Undoubtedly, Leucippus and Democritus believed in the existence of the *psuchē*, and can reasonably be said to have had a theory of its nature, in that they attempt to give an account of it and of certain of its functions in terms of the atomic theory, and thereby to bring it within the compass of their general theory of the physical world. But the *psuchē* cannot be identified with the mind. Basically, the *psuchē* is what differentiates a living from a non-living thing, and the extent to which the *psuchē* includes specifically mental functions such as thought and consciousness is a matter for detailed investigation (and, not infrequently, debate) in the case of early Greek philosophers. We can be clear that the atomists thought that thought and perception belonged in some sense to the *psuchē*, and therefore that some account of them fell within the scope of their general account of the latter. What is much less clear is the degree to which they may be thought to have differentiated either the mental functions as a class from other functions of the *psuchē*, or the specific mental functions from one another.

Ancient authorities do indeed refer to works of both Leucippus (**L1** [= **74d** (Stobaeus)]) and Democritus (**40** (46)) entitled *On the Mind* (*Peri Nou*). We have no reason to assume that that title was given to either work by its author himself; what their use attests is that some later author or librarian classified those works or portions of works under that heading. (Diogenes Laertius, our source for the Democritean title, adds a note indicating that

the two works which Thrasyllus lists separately as *On the Mind* and *On the Senses* were counted by some other authorities as a single work *On the Soul* (perhaps parts I and II of that work).) But at least, it might be said, these citations provide evidence of the existence of works on the topic of the mind, whether so entitled or not. In fact, what they provide evidence for is the existence of works on topics which the originators of the citations classified as being about the mind. In itself, this evidence takes us no nearer to answering the question how, and how clearly, the atomists themselves demarcated the mind from other aspects of human functioning, and what kind of account they gave of it. For that we have to go to our evidence of the content of their work in this area.

In **179a** Sextus attests that Democritus distinguished thought from perception; the real nature of things is inaccessible to the senses, and can therefore be apprehended only by thought, which nevertheless relies on evidence provided by the senses (**179c**). Thought is ascribed in the latter passage to the *phrēn*, the standard Homeric term for the seat of thought, also applied by Xenophanes (DK 21 B25) and Empedocles (DK 31 B134) to the Divine mind which controls the cosmos.[31] This looks like unambiguous evidence for the separation of the mind from other psychic functions. On the other hand we have the assertions of Aristotle (**107**) that Democritus simply identified the soul and the mind, and of Philoponus and others (**110d**) that he identified thought and perception. On certain interpretations, e.g., that Democritus maintained either

(i) A thinks of *o* if and only if A perceives *o*
or (ii) A thinks that *p* if and only if A perceives that *p*,

the latter claim is so manifestly false that the most elementary principle of interpretative charity demands that Philoponus et al. must be interpreted in some other way. More detailed consideration of the evidence of Aristotle and Theophrastus on Democritus' treatment of the *psuchē* and its functioning may suggest such an interpretation.

We may approach the topic indirectly by considering whether the atomists anticipated Plato and Epicurus in separating rational and non-rational 'parts' of the soul. Here we have a clear conflict of evidence. On the one hand two passages from ps-Plutarch's *Epitome* (**110a–b**) report that Democritus separated the intellect from the rest of the soul and assigned it

31 Democrates 112 attests the use of the word *nous* and the ascription to *nous* of thought.

a specific bodily location. On the other, Philoponus and Tertullian explicitly deny that Democritus distinguished rational and non-rational parts of the soul (**110c**), while Lucretius (**110f**) and Sextus (**110e**) attest that he did not assign any specific bodily location to the mind, but held it to be scattered or spread out through the whole body. Further, the two passages of ps-Plutarch are inconsistent with one another; **110a** identifies Democritus' view with that of Epicurus, which distinguishes the intellect, located in the chest, from the non-rational soul scattered throughout the whole body, while **110b** (followed by Theodoretus **110c**) ascribes to Democritus the Platonic doctrine that the 'controlling element' (*hēgemonikon*, i.e., the intellect) is located in the head. It is clear that the compiler of the *Epitome*, who sets down these inconsistent views in adjacent chapters, did not have direct access to Democritus' writings on this topic. But crucially, the evidence of Lucretius is decisive against either version of the thesis that Democritus ascribed to the intellect a specific bodily location. In *De Rerum Natura* III Lucretius argues for the Epicurean distinction, applying the term 'animus' to the intellect, located in the chest, and 'anima' to the non-rational soul, distributed throughout the body. In arguing for this theory he criticizes various alternative views, among them the 'holy opinion' of Democritus that the atoms composing the animus are disposed throughout the body alternately with those composing the bodily organs and limbs (**110f**). In the face of this explicit testimony, both of the conflicting doctrines recorded by ps-Plutarch must be set aside. But the force of Lucretius' testimony goes beyond establishing that the mind is not located in any particular part of the body. It also has the clear implication that mind-atoms are not some subset of soul-atoms; rather the living human being is composed of an interconnected web of mind-atoms and body-atoms, matched one to one. Clearly, soul-atoms and mind-atoms are the same set of atoms. Hence, to the extent that the atomists distinguished thought from perception and other psychic functions, they must have been attempting to identify distinct functions of the same psycho-physical entity, not to assign distinct functions to physically distinct entities, whether bodily organs or 'parts' of the soul.

The doctrine that the soul and the mind are composed of one and the same collection of atoms gives a clear sense to Aristotle's assertions (**107a–b**) that Democritus simply identified soul and mind. It does not, however, suffice to explain the evidence of Philoponus et al. (**110d**) that he identified thought with perception. Further, it appears that the identification of mind and soul was a stronger thesis than the simple one that they have the same material constitution, since in **107a** Aristotle says that Democritus' reason for identifying the two was that 'truth is what appears' (*to gar alēthes einai to phainomenon*). Aristotle's thought would seem to be that Democritus

held that the grasp of truth, traditionally the function of the mind, was achieved by perception, hence mind and soul (the seat of perception) are identical. If that is so, then he is ascribing to Democritus a criterion of identity which goes beyond the material to the functional; mind and soul are identical not merely in that they have the same matter (i.e., atoms), but also in that their function is identical. Philoponus' testimony also points towards ascribing to the atomists the identification of the function or activity of thought with that of perception. But how can such an identification be made consistent with the epistemological gulf opened up by the passages cited in **179**? Must we after all concede that Democritus' account of the mind and its faculties was radically inconsistent?

The answer to that question depends on how we understand the claim that the functions of thinking and perceiving are identical. In evaluating this doxographical assertion we face the difficulty that our sources, above all Theophrastus, give us vastly more detail about the atomists' account of perception than about their account of thought. Theophrastus mentions thought only in a single paragraph (**113** (58)) appended to his description of Democritus' account of sight and hearing, in which he says that about thought Democritus said merely that it occurs when the constituents of the soul are properly balanced, and is affected by excess of heat or cold. If we may trust Theophrastus, then, Democritus said virtually nothing about thought as a topic in its own right, either because he simply ignored the subject or because he took it that his explanation of perception applied to thought also. Some features of our evidence suggest that the latter explanation is correct. In **131a–b** Cicero discusses the Epicurean theory of thought, mentioning in passing that it is essentially the same theory as Democritus'. On that theory (see LS **15**, vol. 1, pp. 72–8), thought is produced by the same mechanism as perception, viz. by the impact on the mind of extremely fine, fast-moving films of atoms (*eidōla*) constantly emitted in continuous streams by everything around us. This theory combines a causal account of both perception and thought with a crude pictorial view of thought. The paradigm case of perception is vision; seeing something is picturing it, and picturing it consists in having a series of actual physical pictures of the thing impinge on one's soul. Thinking of something similarly consists in having physical pictures impinge on one's soul. The only difference, in the Epicurean version of the theory, was that in thought the images had to reach the central intellect, whereas sense-images were received by the sense-organs (including the soul-atoms which pervade those organs). In order to penetrate to the centre thought-images have to be finer textured than sense-images, which are too coarse in texture to pass through the sieve of the sense-organs (Lucretius IV.722–48). Since it seems that Democritus made no distinction

between soul-atoms and mind-atoms, that refinement cannot have been available to him. He would therefore appear to have been committed to the view that the difference between thought and perception amounts to nothing more than a difference of route by which external stimulation reaches the mind; stimuli which are channelled via the sense-organs to the web of mind-atoms permeating the body are sensory stimuli, whereas those which arrive at the mind-web without passing through a sensory channel are thought contents. Theophrastus' evidence in **113** suggests that that was indeed Democritus' view. There is an obvious difficulty, that touch, unlike the other senses, is exercised not via organs with a specific bodily location, but via the body as a whole (or perhaps the outer surface of the body as a whole). Democritus had therefore no means of differentiating thought from touch, which gives an added point, not apparently noticed by Aristotle, to the latter's complaint (**116**) that in explaining all sensory stimulation by impact he makes all the objects of the senses objects of touch.

But what then becomes of the contrast between 'genuine' and 'bastard' judgment and the dramatic conflict between the mind and the senses (**179a, c**)? It is worth noting that the contrast in the former passage is between two kinds of *gnōmē*, ways of thought, and that the two are contrasted as follows: when 'bastard' judgment reaches its limits, 'genuine' goes to a finer degree (*epi leptoteron*). The following suggestion is avowedly speculative, but seems to me to explain how Democritus might have attempted to reconcile that contrast with the view that thought and perception are to be explained by a single mechanism. Thought and perception both consist in the impact of *eidōla* on the soul, and there is no distinction between parts of the soul, such that one part is activated by one kind of *eidōla* and one by another. There are, however, different kinds of *eidōla*; some are so structured as to fit the structure of the sense-organs, which channel them to the mind, while others are so structured as to impact the mind directly. The secondary qualities are represented by *eidōla* of the former type, the structural properties of atomic aggregates (including the properties of individual atoms) by *eidōla* of the latter. That atomic theory did recognize different kinds of *eidōla* is indicated by Lucretius' distinction of the 'finer' ('magis ... tenuia textu') *eidōla* which penetrate to the mind from the coarser which stimulate the sense-organs (IV.728–31). I suggest that that distinction may have been originated by Democritus to account for the difference between the two kinds of *gnōmē*. Put at its crudest, the view would be that thought and perception are simply different sorts of picturing, and that differences in the character of the pictures are determined by differences in the nature of the stimulating *eidōlon*, which in turn determine the route by which the *eidōlon* reaches the mind. Of course, that is not a satisfactory theory,

since ex hypothesi the secondary qualities are themselves dependent on the structural properties of atomic aggregates. Hence, e.g., a given atomic structure is apt to be registered in perception as green or sweet, and in thought as polygonal. If the only function of the senses is as conduits to channel the *eidōla* to the mind, it seems impossible to explain why the same structure is registered in one way if it comes in by one route and in another if it comes in by another. The theory needs to give some account of the processing of data by the various senses, but such an account is lacking. One might speculate that recognition of such difficulties may have stimulated Epicurus and his school to try to improve on Democritus' theory by differentiating the intellect from the rest of the soul.

The atomists' 'identification' of thought and perception may thus be seen as a primitive foreshadowing of the ideas that thought and perception are ways of being in touch with the world, and that being in touch with the world is at least in part a causal notion. My seeing the Eiffel Tower requires that the Eiffel Tower be part of the cause of my perceptual state; equally, my thought can be of the Eiffel Tower only if the actual tower contributes appropriately to the causation of my mental state. The answer to the question raised at the beginning of this section is therefore that the atomists had a conception of the mind in so far as they had a conception of ways in which the world so affects human agents as to make them aware of it. The bulk of the evidence presents this process as one in which the perceiver/thinker is totally passive; the world, we might say, simply thrusts itself in on us in the form of physical imprints which, to paraphrase Locke (*Essay* II.i.25), we can no more avoid or alter than a mirror can the images reflected in it. It is doubtful whether the theory made any room for selectivity or classification of data.[32] Certainly we have no evidence that Democritus had a theory of concept formation, and hence any way of accounting for the structure of thought, including such features as generalization, tense, or conditionality. Hence despite the central role of experience in his thought (see 'Epistemology'), it would be anachronistic to characterize his theory as an empiricist one. The basic doctrine of empiricism is that thought is derived from experience, but it is closer to the spirit of fifth-century atomism to say that thought is

32 Mugler 67, pp. 35–7 interprets the statement at Stobaeus I.51.5 (**114**) that there are more *aisthēseis* than objects of sense as evidence for the activity of the mind in selecting from the continuous barrage of external stimulation those items which are to be registered in consciousness, comparing Lucretius IV.802–15. That requires that *aisthēseis* should apply to potential sense-objects, contrasted to actual *aisthēta*; that usage seems not to be otherwise attested. It appears unwise to rest such a large claim on such a dubious foundation. (Beare 59, p. 207 takes the passage as evidence that Democritus believed in subliminal perception.)

a form of experience, or more precisely that the categories of thought and experience are insufficiently differentiated to allow one to be characterized as more fundamental than the other. For example, it is not a requirement of the theory that the thought of a centaur should be, as in classical empiricist theory, put together out of memory images of a man and a horse, themselves in turn traces of sense experiences of some man (or men) and some horse (or horses). In atomist terms, it is perfectly possible for *eidōla* emitted by some man and some horse to combine (in the air, of course, not in anyone's mind) to form the *eidōlon* of a centaur, and for that *eidōlon* to impinge on the mind (i.e., soul) of someone who had never previously seen either a horse or a man.[33] Thought about the nature of things (i.e., atoms and the void) is evidentially grounded in experience, as we have seen, in that the task of such thought is to account for the appearances; but thought as such is not conceptually derived from experience, as in classical empiricism.

The fundamental cognitive process is the impression of *eidōla* from the environment on the subject of awareness, i.e., the mind/soul. It appears that the various sensory modes are differentiated from one another by the various routes by which the soul is stimulated; thus the stimulation of the soul-atoms throughout the body via the eye constitutes seeing (**113** (54)), via the ear hearing (ibid. (57)), etc. The specification that the impact of the *eidōla* is transmitted from the sense-organ to the body (and therefore the soul) as a whole may be intended to explain how the data of the various senses are integrated into perception of complex objects; the body as whole then fills the role of the central sensorium in Aristotle's theory.[34] It is unclear how far perception itself was held to involve thought, and how perception of sensible objects was distinguished from non-perceptual thought of those very objects. On the first point, if *eidōla* from a green sphere strike my eye, do I, in seeing a green sphere, ipso facto think of a green sphere? On the second, does, e.g., imagining a green sphere itself involve stimulation of the eye by an *eidōlon* from a green sphere? If it does, then imagining is itself a sort of seeing. If it does not, then is imagining a mode of stimulation of the soul which does not involve the eye? If any non-visual stimulation is sufficient for imagining, then, e.g., touching a green sphere with the sole of one's foot ought to cause one to imagine a green sphere. If, on the other hand, some specific mode of non-sensory stimulation is specified, the theory

33 Someone who thinks of a centaur is, then, ipso facto seeing a horse, viz. whichever horse it was which emitted the *eidōlon* of that bit of the horse which forms part of the *eidōlon* of the centaur; thinking of a centaur thus involves *current* experience of a horse, not *prior* experience as in classical empiricism.

34 So Bicknell 60.

is approaching the Epicurean distinction of the mind from the senses. These questions are unanswerable, and the fact of their unanswerability prompts the further unanswerable question whether their unanswerability is due to the undeveloped nature of the theory, or merely to the fragmentary state of the evidence which has come down to us.

If we take seriously the atomists' view of the soul as a fine structure of spherical atoms permeating the entire body, we should expect the *eidōla* emitted by living things themselves to contain soul-atoms, and hence themselves to be alive. It might be objected[35] that *eidōla* flow from the surfaces of bodies, whereas the soul is internal, but it is precisely the latter claim which the picture of the soul as permeating the *whole* body is designed to refute.[36] After all, the soul is what accounts for perception (**106a**), and the whole of the surface of the body (i.e., the skin) is a sense-organ. Indeed, if we take literally the claim recorded by Lucretius (**110f**) that soul- and body-atoms are arranged alternately, precisely half the atoms constituting the external surface of the human body are soul-atoms (and presumably the same goes for other animal species too). It follows that half the atoms which make up each *eidōlon* emitted by an animal must be soul-atoms, and hence that *eidōla* of living things are themselves alive.

That that was indeed the teaching of Democritus is suggested by evidence from two related areas, his account of dreams and his theology. In general, the occurrence of dreams is explained by the theory of *eidōla*; dreaming is essentially imagination occurring during sleep, and like waking imagination is explained by the impact of stray *eidōla* (**132–3**), originally, of course, emitted by real things, but frequently distorted by collisions with one another (**131b**). The evidence that some dream *eidōla* are alive comes from the two passages from Plutarch cited as **133a** and **b**. The first of these reports that dream images represent not merely physical features, but also psychological states such as desires and feelings 'and when ... they collide with people they talk as if they were alive, and tell those who receive them the opinions, words and actions of those who emitted them.' By itself, of course, this does not require that the images should themselves be alive, any more than the images on a cinema screen, but merely that they represent the behaviour, including the speech and movements, of living beings. They might be said to talk in the same sense as 'talking' films, 'as if they were alive,' which might well be taken to imply that they are not alive.[37] **133b**, on the other hand, makes it pretty clear that Democritus' view was that at least

35 Sassi 69 makes this objection, pp. 74–5.

36 See Bicknell 60.

37 So Barnes 7, ch. 21 (c).

some dream *eidōla* actually possess the psychological traits of the people who emit them. The *eidōla* sent out by malevolent and wicked people are themselves malevolent and wicked, and it is because they actually possess those characteristics that they have harmful psychological effects on some people.[38] Someone who was determined to resist this suggestion might perhaps, at a pinch, read even this evidence in a 'reductionist' sense; though the images are not literally malevolent they are so vivid that encountering them is just as frightening as confrontation with the original, hence their harmful effects. But given that the theory leads us to expect that *eidōla* of living things should themselves be alive, that manoeuvre loses whatever plausibility it might have had. Further, the theory of living *eidōla* is strongly confirmed by the evidence of Democritus' views about the gods, which will be considered in the next section ('Theology').

Most of our detailed information on Democritus' psychology is concerned with perception, provided by Theophrastus in *On the Senses* (**113**). The descriptive part of Theophrastus' account gives summary descriptions of the processes by which the impact of atoms from the environment stimulates the various senses, supplemented by a certain amount of detail of the particular atomic arrangements which give rise to different colours and tastes; both general and detailed accounts are criticized at some length. The following points may be noted as particularly significant.

In general, the senses are activated by the impact of streams of atoms from surrounding objects, but the mechanics of particular senses present some peculiarities. Theophrastus lays particular stress on a special feature of Democritus' theory of vision, that the sense is acted on not directly by *eidōla* from the surfaces of objects in the vicinity of the perceiver, but indirectly, in that those *eidōla* stamp impressions on the air between the perceiver and the perceived object, and it is the volumes of compressed air carrying those impressions which impact on the sense organ (**113** (50)). (Indeed, his criticisms of the theory of vision are almost exclusively confined to this feature.) His extremely schematic description raises a number of difficult questions: (i) why did Democritus introduce air-impressions? (ii) is

38 So Bicknell 61. There seems to me, however, insufficient reason to accept his claim that dream *eidōla* are 'phantoms,' entities of a quite different type from the *eidōla* constantly emitted by all bodies and registered in thought and perception. A single type of *eidōlon* seems to me sufficient to account for all the phenomena. That has the implication that the *eidōla* of living beings which we receive in perception are themselves alive, and that the information which they convey to us is not confined to the appearance of others, but includes their psychological states.

the theory of air-impressions consistent with Aristotle's statement (**118**) that according to Democritus one could see an ant in the heavens if the intervening space were empty? (iii) how are air-impressions produced? In particular, what is the contribution of the perceiver to their production?

The answers to questions i and ii are connected to one another. Clearly, if Democritus believed that the formation of air-impressions was necessary for the transmission of *eidōla* from the perceived object to the perceiver, then one could not see an ant, or anything else, across a void. So if the answer to i is that *eidōla* could not cross a void, but require air-impressions as a vehicle, then the answer to ii is that that theory is inconsistent with Aristotle's evidence. But it is totally implausible that Democritus should have held that *eidōla* could not cross a void; for what could stop them doing so? Obviously, nothing. So far from its being the case that the presence of a void between perceiver and object would be an obstacle to perception (as it would in Aristotle's theory, which required a medium for the transmission of sensible forms), that situation would be the *ideal* condition for the transmission of *eidōla*, since there would be no intervening atoms to disrupt or deflect them. And that is surely the point of Aristotle's remark; given a situation where there is no obstacle to the *eidōla*, even the tiniest object at the greatest possible distance would be seen with perfect clarity.[39]

What, then, is the role of air-impressions? Broadly speaking, they are posited as part of an account of visual perception in the non-ideal conditions constituted by the fact that *eidōla* have to traverse, not a void, but a space occupied by a physical stuff, viz. air. The *eidōla* have to force their way through this relatively dense medium, and in so doing they drive a mass of air in front of them to the eye. But why should Democritus not have supposed that they disperse the intervening air, rather than compacting it? Here we have to speculate, since our sources are silent. He may have believed that the hypothesis of intervening air-masses gave the best explanation of the interference of the environment in vision, as evidenced, e.g., by the facts that the further away things are the less distinctly they are seen, and that they are seen less distinctly in fog than in clear air. A distant object arrives at the eye on the other side of a thicker mass of air than a nearer one; hence there are more air-atoms between the eye and the object in the former case, giving us a less distinct sight of the object. If this is correct, the function of the air-impressions is not to explain how visual perception occurs, but to explain why it is subject to the limitations which we observe.[40]

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39 See Baldes 57.

40 O'Brien 68 suggests that the function of the air-impressions is to account for the perception of the distance of the perceived object, as distinct from the perception of the

Theophrastus' terse summary leaves the details of the formation of air-impressions in some obscurity. As well as the *eidōlon*, the observer (50) and the sun (54) have some role, but it is hard to be sure precisely what those roles are. The reference to the sun is clearly supposed to explain why we don't see in the dark; apparently the sun condenses the air-masses and pushes them towards the eye. Hot air being more mobile than cold,[41] we can see how *eidōla* are more readily transmitted though the warm air of day than the cold of night, but it is obscure why the sun condenses air-masses, and why the effect of such condensation is not to make perception more difficult (see above). As regards the observer, Theophrastus simply describes the air 'between the sight [*opsis*] and the thing seen' as being 'compacted [*sustellomenon*] by the seer and the thing seen' and 'having an impression made on it [*tupousthai*].' This has been variously interpreted. Some scholars[42] have taken it to ascribe to Democritus a theory similar to that of Plato (*Timaeus* 45b, 67c–d), in which the impression is formed in mid-air by the collision of the *eidōlon* from the object and a visual ray emitted from the eye, thus attributing to the seer an active role in vision. Others[43] have taken it to describe a process in which the air at the surface of the eye is compacted between the eye and the *eidōlon*; on this view the perceiver is no more active in vision than in the exercise of any of the other senses. Both views have their difficulties. Against the second view, Theophrastus clearly includes the observer's part in the formation of the air-impression in the explanation 'as everything is always giving off an effluence.' Effluences from the observer (not merely the resistance of the eye to the impact of the impression) therefore contribute to the formation of the impression. On the other hand, there is no support in

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object itself. He cites Lucretius IV.244–53, which attributes the perception of distance to our perception of the flow through the eyeball of the wind driven before the *eidōlon*; the longer it takes for the wind to blow through the eye, the more distant we judge the thing seen. He also cites Alexander on *De Sensu*, 57.28–58.1, which mentions, apparently in connection with Aristotle's criticism of the atomists' account of perception, the view that it is by means of the quantity of air impacting on the eye in advance of the *eidōlon* that we perceive distance. If Democritus did in fact hold that air-impressions were essential to perception of distance, it is surprising that Theophrastus does not connect the perception of distance with his treatment of air-impressions; he mentions the perception of distance only in a remark appended to his discussion (54), that while Democritus tries to say how size and distance are perceived he does not succeed in explaining it.

41 See **106–7** for the atomists' view of the connection between heat and mobility.

42 Guthrie 9, p. 443; von Fritz 72, pp. 612–13. The most elaborate version of this theory is that of Burkert 62.

43 Baldes 56, Barnes 7, ch. 22, n. 9, O'Brien 68, n. 60.

the texts for the hypothesis of the emission from the eye of a visual ray. All that the texts support is that the observer, like all physical objects, emits effluences, which collide with the air atoms and with the effluences from objects of perception to form air-masses, which then, stamped with impressions from the objects of perception, impact on the eye. The seer does not, then, contribute anything to the mechanism of perception; rather, purely in virtue of his/her physical nature, he or she contributes to the physical conditions which constitute the limitations to which perception is subject (see above).[44]

(For other points of detail, see the notes to **113**.)

THEOLOGY

Democritus' theology is naturalistic, in its accounts both of the nature of the gods and of the origins and grounds of belief in their existence. Despite obscurity over some details (see below), it is clear that he believed that there are gods, which are living, intelligent, material beings (of a peculiar sort), playing a significant role in human affairs. They are atomic compounds, and like all such compounds they come to be and perish. They did not, of course, create the physical world (of which they are part), nor, though they are intelligent, do they organize or control it. (For discussion of the atomists' denial of providence, see above on Chance and Necessity.) They are as firmly part of the natural order as any other living beings.

What kind of beings, then, are they? The answer to this question connects with the discussion of the previous section, since there is clear evidence that Democritus believed the gods to be living *eidōla*, probably of gigantic size, possessing intelligence, moral character, and interest in human affairs.[45] Diogenes of Oenoanda (**211**) criticizes this theory from an Epicurean standpoint; perception, intelligence, and the use of language require a solid subject, and cannot therefore be attributes of mere atomic

44 So Sassi 69, pp. 108–9 (citing earlier authorities at p. 109, n. 50). It is not always easy to be sure whether a given writer is maintaining this position or some version of the 'Platonic' account mentioned above (see n. 42).

45 Barnes 7, ch. 21 (*c*) agrees with Cicero's Balbus (**172b**) in interpreting Democritus' theory of the gods as amounting to atheism, since in holding the gods to be *eidōla* he takes them to be nothing more than the contents of human fantasy, particularly in the form of dreams. (Similarly Vlastos 115, n. 24 'consider[s] the *eidola* as an aetiological explanation of the popular belief in the gods, and nothing more.') But for Democritus *eidōla* are not intrinsically psychological; they are not contents of psychological states, but part of the objective world, causing psychological states through their impact on physical minds.

films.[46] This criticism presumably relies on the Epicurean doctrine that the mind is an internal organ situated in the chest; given that doctrine, films of atoms flowing off the surfaces of bodies cannot themselves possess mentality. But we saw in the previous section that, per contra, the Democritean picture of the mind as suffused throughout the entire body, including its surface, entails the possession of mentality by the *eidōla* emitted by a mentally endowed being. The account of the gods as *eidōla* is clearly attested by Cicero (**172a–c**), Augustine (**172d**), Plutarch (**175a**), and Sextus (**173b, 175b**); the latter passage is especially significant in containing, among other detail, the explicit statement that *eidōla* were the only kind of divine beings which Democritus recognized.

That presents a prima facie difficulty, both because the theory might seem to require that living divine *eidōla* must be emitted by living divine beings, of which they are *eidōla*, and because passage **172a** contains some suggestion that as well as the *eidōla* Democritus postulated gods of other kinds. The first difficulty is illusory; every *eidōlon* must be emitted by some atomic aggregate or aggregates,[47] but there is no requirement that an *eidōlon* of a thing of a certain kind should have been emitted by an actual thing of that kind. An *eidōlon* of a centaur need not have flowed from the surface of an actual centaur, but could have arisen from the chance collision of *eidōla* flowing from the surfaces of a horse and of a man (see above). Since according to Sextus (**173b**) Democritus' gods were in human form, the theory need have no difficulty in identifying their source as actual humans. But what about the detail that they are of enormous size, or even, as stated by Cicero's Cotta 'of such an enormous size as to enfold the entire world' (**172c**)?

It is important to be clear on whether Democritus' doctrine was (i) that the gods are *eidōla*, of enormous size, of living beings in human form, or (ii) that the gods are *eidōla* of living beings of human form and of enormous size. Doctrine i requires that the *eidōla* are themselves enormous, ii does

46 In the light of this criticism, it is particularly interesting that Long and Sedley 86 vol. 1, pp. 144–9 attribute the Democritean theory to Epicurus himself, and come very close to accepting Barnes' characterization of it as amounting to atheism.

47 This assumes that all *eidōla* are of the same kind, viz. the kind described in our sources for the atomists' theories of perception and thought. Eisenberger 84, pp. 147–8 appears to envisage that the divine *eidōla* are of a distinct kind, viz. free-standing atomic films in human form, which have no source other than the atoms which constitute them and the forces which form those atoms into aggregates. (Bicknell 82 has a similar view.) Considerations of economy count against this multiplication of kinds of *eidōla*; 'conventional' *eidōla* can explain the phenomena just as well as the special sort postulated by the authors mentioned.

not.[48] If Democritus' doctrine was ii, there is no difficulty in accounting for the origin of such images. They originate from ordinary humans, and there is no question as to how they have attained their enormous size, because they do not have enormous size. There is of course the question of how they come to represent things as of enormous size; this is essentially a question about Democritus' theory of mental representation, which prompts fascinating speculation with, unfortunately, little or no textual foundation. Did Democritus believe that we can somehow alter the relative dimensions of the *eidōla* of a human being and of a mountain to produce the image of a human being the size of a mountain? Describing Epicurus' theory, Sextus says (*Against the Mathematicians* IX.45) that we form the conception of a Cyclops by 'magnifying the ordinary man in fantasy'; this might refer to first imagining a man of ordinary size and then simply imagining a much bigger man (which is relatively unproblematic), or to the more problematic activity of first forming the mental image of a man of ordinary size and then somehow magnifying that image to generate the image of a man of much greater size. Given Democritus' account of thought as stimulation by *eidōla* (see previous section), if he held anything like the view which Sextus attributes to Epicurus, it must have been more like the latter, problematic version. But the attribution to the mind of powers to operate on its *eidōla* is something of which there is no trace in the textual evidence; moreover, given the physical nature of *eidōla*, the mind would presumably have to enlarge them physically, and it is hard even to envisage how it might be supposed to do that.

Given these problems, it might be easier to suppose that Democritus' theory was i, viz. that the divine *eidōla* actually are of enormous size. In that event, where do they come from? Various possibilities suggest themselves. One is that their source was actual gigantic humans, perhaps living in the remote past. (We know that the divine *eidōla* were especially long-lasting (**175b**).) Another is that, though originating from humans of normal size, they became enormously enlarged through accretion of extraneous atoms in the course of their long life. A third is that they emanate from gigantic humanoid inhabitants of another world than ours.[49] In any of these events

48 It appears that Epicurus held that an *eidōlon* representing its source as F (e.g., a visual impression of a distant tower as small and round) was itself F (see Taylor 96), but there is no evidence to justify the ascription of that doctrine to Democritus.

49 This might explain 'of such an enormous size as to enfold the entire world' (**172c**). If the atomists believed that there are remote worlds composed of atoms of enormous size (see above, 'Differentiating Properties of Atoms'), then the *eidōla* emitted by inhabitants of those worlds might be big enough to enfold the whole of our world.

the theory is spared the problem of explaining how the mind enlarges its *eidōla*, but at the cost of having instead to explain how *eidōla* larger than a human body could be physically registered by that body; clearly the simple model of a seal impressed on wax is inadequate, but the sources suggest no alternative.

According to Cicero (**172c**), Plutarch (**175a**), and Sextus (**175b**), some of these *eidōla* are harmful and some beneficial, while Sextus adds that they foretell the future by speaking to humans. The wording of the Cicero and Sextus passages leaves it open whether the good and harm done to humans are conceived as mere natural effects of the encounters with the *eidōla*, or effects intentionally brought about by them; Plutarch, on the other hand, clearly interprets Democritus as holding the latter view, since he credits him with thinking that some *eidōla* are malicious, and with praying to meet only those which are 'propitious' (i.e., those which are well disposed, by contrast with the wicked). Sextus' testimony of the prophetic activity of the *eidōla* confirms that they act intentionally, which in turn confirms Plutarch's testimony of their beneficence or malevolence. (Prophecy is presumably an instance of beneficence, on the assumption that prophecies are normally intended to benefit those to whom they are delivered.)

Most of our other evidence is consistent with the above doctrine, though in some cases suggestive of misunderstanding on the part of the authors who transmit it. Thus the report of Stobaeus (**171a**) that god is mind in spherical fire, the suggestion of Cicero's Cotta that the gods are the basic principles of mind in the universe (**172c**), and even St Cyril's extravagant-sounding assertion that according to Democritus god is the soul of the world (**171a**) are all best read as versions, garbled according to the preconceptions of each author, of the authentic Democritean doctrine that the divine *eidōla*, as living beings, contain a high proportion of soul-atoms, which we know to be spherical and therefore fiery (cf. **106**). The statement of the elder Pliny (**174**) that Democritus believed in just two gods, Punishment and Reward (or perhaps 'Good and Harm' ['Poenam et Beneficium']), is presumably an echo of his doctrine that the divine *eidōla* are either beneficent or hostile. Rather more worrying is the suggestion of Cicero's Velleius (**172a**), echoed by Augustine (**172d**), that in addition to the *eidōla* themselves Democritus believed that the beings which emit the *eidōla* are also divine. This, if accurate, would ascribe to Democritus a hybrid theory incorporating both the belief in living *eidōla* and the theory of later Epicurean sources (and perhaps, though disputed by Long and Sedley (see n. 46 above) of Epicurus himself) that the gods are living beings apprehended via *eidōla*. Lactantius (**172e**) goes to the length of denying that the gods were composed of atoms,

since it was impossible for atomic compounds to exist eternally. We can be certain that this misrepresents Democritus. Even if, like some of his successors, he believed in gods over and above the divine *eidōla*, he is as firmly committed as they to the doctrine that those beings are apprehended by humans via *eidōla*. But only atomic compounds can emit *eidōla;* hence the gods must be atomic compounds, and like all compounds must eventually be dissolved. The version of the hybrid theory suggested by the texts of Cicero and Augustine, which does not include the thesis of the eternity of the gods, cannot be set aside so easily. It is, however, explicitly contradicted by Sextus (**175b**), which suggests that we should look for some way of understanding this testimony as a distortion of some aspect of the *eidōla* theory. We might tentatively suggest that Democritus described the sources of his divine *eidōla* as themselves gods in a reductive spirit; we encounter (in dreams etc.) *eidōla* of gods, and what those 'gods' (i.e., the things that produce those *eidōla*) really are are nothing but men of old.[50]

We should consider whether any light is thrown on this question by the evidence of Democritus' views on the origins of religion. The sources identify two types of phenomena as having given rise to religious belief, firstly the occurrence of *eidōla* themselves (**175b**), and secondly celestial phenomena such as thunder, lightning, and eclipses (**173a**). The latter testimony is supported by the quotation recorded by Clement (**D14**), which describes a few learned people raising their hands to the sky and saying that Zeus ordains all things, i.e., ascribing all celestial phenomena to divine agency. It is likely that these accounts were seen by Democritus as in one way or another complementary. He may simply have thought of them as mutually reinforcing kinds of evidence. Or perhaps, in a more sophisticated manner, he appealed to *eidōla* to explain how humans acquired the concept of gods, and to celestial phenomena to explain why they believed that gods exist. The fragment may be taken to give some support to the reductive interpretation suggested in the preceding paragraph. Certainly it can itself be read reductively; what we now call (i.e., what really is) air the learned men of the past called Zeus, i.e., Zeus really is nothing but air.

Democritus' theology thus contrives to incorporate some of the most characteristic features of the gods of traditional belief, notably their anthropomorphism, power, longevity (though not, crucially, immortality), personal interaction with humans, and interest (for good or ill) in human affairs, within the framework of a naturalistic and materialistic theory. It

50 The hybrid theory is defended by McGibbon 87, and criticized (to my mind effectively) by Eisenberger 84.

is thus, despite the bold originality of its account of the divine nature, notably more conservative than some of its predecessors (especially the non-anthropomorphic theology of Xenophanes) and than its Epicurean successor, whose main concern is to exclude the gods from all concern with human affairs.

EPISTEMOLOGY

While we have no evidence to suggest that Leucippus was particularly concerned with epistemological questions, there is abundant evidence of their importance for Democritus. It is quite likely that the latter's epistemological interests were stimulated at least in part by his fellow citizen and elder contemporary Protagoras (see below). Our evidence is highly problematic, in that it provides support for the attribution to Democritus of two diametrically opposed positions on the reliability of the senses. On the one hand, we have a number of passages, including some direct quotations, in which he is seen as rejecting the senses as totally unreliable (**179a**, **180**, **182a–f**, **184a–b**); on the other, a number of passages ascribe to him the doctrine that all appearances are true (**42a–b**, **177**, **183a–b**), which aligns him with Protagorean subjectivism, a position which he is, however, reported as having explicitly rejected (**178c**, **181**). The former interpretation is supported mainly by evidence from Sextus, and the latter mainly by evidence from Aristotle and his commentators, but we cannot resolve the question by simply setting aside one body of evidence in favour of the other, since (i) in the course of a few lines (**177**) Aristotle says both that Democritus says that either nothing is true, or it is unclear to us, and that he asserts that what appears in perception is necessarily true, (ii) in **179a** Sextus ascribes some of Democritus' condemnation of the senses to a work in which 'he had undertaken to give the senses control over belief.' Prima facie, then, the evidence suggests that both interpretations reflect aspects of Democritus' thought. Was that thought, then, totally inconsistent? Or can the appearance of systematic contradiction be eliminated or at least mitigated?

The former interpretation is based on the atomists' account of the secondary qualities (see above). Our senses present the world to us as consisting of things characterized by colour, sound, taste, smell, etc., but in reality the world consists of atoms moving in the void, and neither atoms nor the void is characterized by any secondary quality. We thus have a dichotomy between how things seem to us and how they are in reality, expressed in the celebrated slogan (**D16**) 'By convention sweet ... in reality atoms and void.' Further, the distinction between the reality of things and the appearances which that reality presents has to be supplemented by an account of the

causal processes via which we receive those appearances. Atomic aggregates affect us by emitting films of atoms which impinge on our sense-organs, and the resulting perceptual states are a function of the interaction between those films and the atomic structure of the organs (**113–30**). Hence we are doubly distanced from reality; not only phenomenologically, in that things appear differently from how they are, but also causally, in that we perceive atomic aggregates via the physical intervention of other aggregates (viz. the atomic films) and the action of those latter on our sense-organs. **D15–21** all stress the cognitive gulf which separates us from reality; **D15–16** and **D18–21** all contain the term *eteē*, which Galen (**179d**) says was a coinage of Democritus' own from the adjective *eteos*, meaning 'real' or 'true,' while **D17** contains the equivalent *tōi eonti*, formed from *to eon*, what is (i.e., what exists, what is real or what is true). We recall that the atomists used 'what is' as a technical expression to designate the atoms (**44a, 45, 46a**). So in insisting that we are removed from reality (**D19**) Democritus is saying that we are removed from the real nature of things, i.e., from the atoms which are external to us. **D17** and **D20** seem to be verbal variants for one another. The former says that in reality (*tōi eonti*) we grasp or understand nothing firm or stable, but something which changes according to the condition of our body and what comes into contact with it. The latter says that in reality (*eteēi*) we know nothing about anything, but each person's opinion is either 'something which flows in' or 'a reshaping.'[51] On either rendering of *epirrusmiē* the point seems to be the same, and to be identical to that made in **D17**, viz. that we have no stable grasp of the reality of things, but that our cognitive state is determined by the fluctuating impact of the environment on our sense apparatus. **D15** gives another reason in support of the assertion that in reality (*eteēi*) we know nothing; 'for truth (or reality, another ordinary sense of *alētheia*) is in the depths (*en buthōi*).' *Buthos* signifies the depths of the sea, beyond the reach alike of the eye or the plumbline; similarly, the atoms, which constitute reality, are beyond the reach of perception or measurement.

The evidence which we have so far examined already presents a major problem of interpretation. On the one hand **D16** and associated reports (**178a–b, 179c, 182c**) stress the gulf between appearance and reality, claiming that the senses are unreliable in the sense that they misrepresent reality. That dogmatic claim presupposes that we have some form of access to reality, which enables us to find the sensory picture unfaithful to how things are in fact. On the other hand, **D15**, **D18**, and **D21** (and perhaps also **D19**)

51 See n. on **D20**.

make the much more radical claim that reality is totally inaccessible, thereby undercutting the thesis that there is a gulf between appearance and reality. **D17** and **D20** attempt uneasily to straddle the two positions, since they draw the radically sceptical conclusion from a premiss about the mechanism of perception which presupposes access to the truth about that mechanism. We might conclude that Democritus simply failed to distinguish the dogmatic claim that the senses misrepresent reality from the sceptical claim that we can know nothing whatever about reality. An alternative strategy is to look for a way of interpreting the evidence which will tend to bring the two claims nearer to consonance with one another.

We can bring the two claims closer to one another if the 'sceptical' fragments are interpreted as referring, not to cognitive states generally, but specifically to states of sensory cognition. These fragments will then simply reiterate the thesis that we know nothing about the nature of reality *through the senses*, a thesis which is consistent with **D16** and which dissolves the apparent tension internal to **D17** and **D20**. There is not, admittedly, much support for this suggestion to be got from the texts of the fragments themselves. It is true that the verb translated 'know' in **D17** and **D18** is *sunienai*, whose original application, in its occurrences in Homer, is to sensory cognition, from which it is extended to the intellect generally in the fifth century (see LSJ). On the other hand the verb in **D15** and **D20** is *idein* and in **D21** *gignōskein*, both of which have the general sense 'know,' with no suggestion of any restriction to sensory knowledge. The suggested interpretation, if it is to be adopted, must therefore depend on external support. But such support is not lacking. The context (**179a**) in which Sextus quotes **D16–21** is that of Democritus' critique of the senses, of which Sextus observes 'In these passages he more or less abolishes every kind of apprehension, even if the senses are the only ones which he attacks specifically.' It thus appears that Sextus understands Democritus as referring in these fragments to the senses only, though in his (i.e., Sextus') view the critique there directed against the senses in fact applies to all forms of apprehension. This is confirmed by the distinction which Sextus immediately (ibid.) attributes to Democritus between the 'bastard' judgment provided by the senses and the 'genuine' judgment provided by the intellect (**D22**). The latter is specifically said to be concerned with things which fall below the limits of sensory discrimination, and we must therefore suppose that the atomic theory itself is to be ascribed to this form of judgment. This is supported by those passages (**182a–b**) in which Sextus associates the position of Democritus with that of Plato, in that both reject the senses as sources of knowledge and maintain that only intelligible things are real; for Plato, of course, the intelligible things are the Forms, whereas for Democritus they

are the atoms, which are inaccessible to perception and, consequently, such that their properties are determinable only by theory.

Thus far the prospects for a unified interpretation of Democritus' epistemology look promising. The position expressed in the fragments cited by Sextus is not general scepticism, but what we might term theoretical realism. The character of the physical world is neither revealed by perception nor inaccessible to us; it is revealed by a theory which, starting from perceptual data, explains those data as appearances generated by the interaction between a world of imperceptible physical atoms and sensory mechanisms also composed of atoms. But now, as Sextus points out (**182b**) and Democritus himself recognized (**D23**), scepticism threatens once again; for the theory has to take perceptual data as its starting-point, so if the senses are altogether unreliable, there are no reliable data on which to base the theory. So, as the senses say to the mind in **D23**, 'Our overthrow is a fall for you.'

Commentators who (like Barnes 7) read **D23** as expressing commitment to scepticism (despairing or exultant, according to taste) on the part of Democritus, naturally reject the unitary interpretation proffered above. On their view **D15** and **D17–21** are not restricted to sensory cognition, but express a full-blooded rejection of any form of knowledge, which must be seen as superseding the distinction between appearance and reality of **D16** and **D22** and the claim to 'genuine judgment' in the latter. Yet Sextus presents **D16–22** in a single context (**179a**), without any suggestion of a conflict within the collection. Moreover, in **178a** he points out that, though the sceptics resemble Democritus in appealing to phenomena of conflicting appearances, such as the honey which tastes sweet to the healthy and bitter to the sick, in fact Democritus uses those phenomena to support, not the sceptical position that it is impossible to tell how the honey is in fact, but the dogmatic position that the honey is itself neither sweet nor bitter (also in **178b** and **182c**). (I interpret the latter as the assertion that sweetness and bitterness are not intrinsic attributes of the structure of atoms which is the honey (see above).) Sextus, in short, sees Democritus not as a sceptic, but as a dogmatist. Indeed, Sextus does not cite **D23**, and it is possible that he did not know the text from which it comes; **182b** shows that he was aware of the problem which is dramatized in the fragment, but he clearly saw it as a difficulty for Democritus, rather than as signalling Democritus' rejection of the basis of his own theory.

At this point we should consider in what sense the theory of atomism takes the data of the senses as its starting-point, and whether that role is in fact threatened by the appearance-reality gap insisted on in **D16**. According to Aristotle (**42a, 48a**) the theory started from sensory data in the sense

that its role was to save the appearances, i.e., to explain all sensory data as appearances of an objective world. Both Aristotle and Philoponus (**42b**) mention conflicting appearances as among the data to be saved; the theory has to explain both the honey's tasting sweet to the healthy and its tasting bitter to the sick, and neither appearance has any pretensions to represent more faithfully than the other how things are in reality. All appearances make an equal contribution to the theory. That is a position which atomism shares with Protagoras, but the latter assures the equal status of appearances by abandoning objectivity; in the Protagorean world there is nothing more to reality than the totality of equipollent appearances. For Democritus, by contrast, the reconciliation of the equipollence of appearances with the objectivity of the physical world requires the gap between appearance and reality. Without the gap a world of equipollent appearances is inconsistent, and hence not objective. But there is no ground for denying equipollence; qua appearance, every appearance is as good as every other. Hence the task of theory is to arrive at the best description of an objective world which will satisfy the requirement of showing how all the conflicting appearances come about.

So far from threatening the foundations of the theory, then, the appearance-reality gap is essential to the theory. But in that case what is the point of the complaint of the senses in **D23**? Surely that text provides conclusive evidence that Democritus believed that the gap threatened the theory, and hence (assuming that he understood his own theory) conclusive evidence against the interpretation which I am advancing. I do not think that the text does provide such evidence, for the simple reason that we lack the context from which the quotation comes. The point of the complaint need not (and given the nature of Democritus' theory certainly should not) be the admission that the theory is self-refuting. It is at least as likely to be a warning against misunderstanding the account of the appearance-reality gap as requiring the abandonment of sensory evidence. We may imagine an anti-empiricist opponent appealing to the gap to support the claim that the senses are altogether unreliable, and should therefore be abandoned. In reply Democritus points out that the attack on the senses itself relies on sensory evidence. Sextus does indeed attribute to Democritus, together with Plato, the view that the senses are altogether unreliable (**182a–b**), but when we put the Aristotelian evidence of the atomists' acceptance of the appearances as the starting-point of their theory together with all the other evidence, including the fragments, we have to conclude that that picture of Democritus is a misunderstanding.[52] The atomists' distinction between appearance and

52 It is a misunderstanding, not only of Democritus, but also of Plato, whose position is that, while the senses do not suffice to give us knowledge of the Forms (*Phaedo* 65–6), they are necessary to remind us of them (*Phaedo* 73a–75b).

reality does not involve 'doing away with sensible things'; on the contrary, appearances are fundamental to the theory, first as providing the data which the theory has to explain and secondly as providing the primary application for the observationally based terminology which is used to describe the nature and behaviour of the entities posited by the theory.[53]

A final objection, however, comes from Aristotle himself, who describes Democritus as concluding from conflicting appearances 'that either nothing is true, or it is unclear to us' (**177**). This is a very puzzling passage, for a number of reasons. Aristotle is explaining why some people go along with Protagoras in believing that whatever seems to be the case is so, and in the immediate context (1009a38 ff.) cites the phenomena of conflicting appearances and the lack of a decisive criterion for choosing between them as conducing to that belief. But at b9 he shifts from the thought that conflicting appearances lead to the view that all appearances are true to the sceptical account of those phenomena, viz. that it is unclear which of the appearances is true or false, 'for this is no more true than that, but they are alike.' This, he says (i.e., the belief that none of the appearances is truer than any other), is why Democritus said that either nothing is true, or it is unclear to us. So Democritus is represented as posing a choice of adopting either the dogmatic stance that none of the appearances is true, or the sceptical stance that it is unclear (sc. which is true). Yet in the next sentence Aristotle says that because he and others assimilate thought to perception (cf. **110c**) they hold that what appears in perception is necessarily true, the position which we have already seen him attribute to Democritus in a number of places. So unless Aristotle is radically confused, the disjunction 'either none of the appearances is true, or it is unclear to us' must be consistent with the thesis that all perceptions are true. If 'it is unclear to us' is read as 'it is unclear to us which is true,' then the claims are inconsistent. I suggest, however, that what Democritus said was to the effect that 'either nothing is true, or it (i.e., the truth) is unclear.' The first alternative he plainly rejected, so he maintained the second. And that is precisely what he maintains in **D15**: the truth (sc. about the atoms and the void) is in the depths, i.e., it is not apparent in perception, i.e., it is unclear (*adēlon*), in the sense that it is not plain to see.[54] That he used the term *adēlon* to apply to atoms and the void is attested by Sextus (**179a**) who cites Diotimus as evidence for Democritus' holding that the appearances are the criterion for the things that are unclear and approving Anaxagoras' slogan 'the appearances are the sight of the things that are unclear' (*opsis tōn adēlōn ta phainomena*). The truth, then, i.e., the

53 Cf. Taylor 114.

54 So Salem 15, 162.

real nature of things, is unclear (i.e., non-evident), but all perceptions are true in that all are equipollent and indispensable to theory.

If that is what Democritus held, then it may reasonably be said that 'true' is the wrong word to characterize the role of appearances in his theory. 'All appearances are equipollent' is equally compatible with 'All appearances are false,' and in view of his insistence on the non-evident character of the truth it would surely have been less misleading for him to say the latter. Though there are some difficult issues here, I shall not argue the point, since I am not concerned to defend Democritus' thesis that all appearances are true. I do, however, accept that he actually maintained that thesis and have sought to explain why he did and how he held it together with (i) his rejection of Protagorean subjectivism and (ii) the views expressed in the fragments cited by Sextus.[55]

ETHICS AND POLITICS

Our evidence for Democritus' ethical views differs radically from that for other areas of his thought. Apart from ethics, the only topic to yield a significant number of quotations from Democritus himself is epistemology; this direct evidence is closely connected to the doxography, firstly in that the epistemological fragments are presented in the context of discussion of Democritus' doctrines by Sextus and Plutarch, and secondly that they have, as we have seen, to be fitted together with the testimony of Aristotle and others in the search for a comprehensive and coherent picture of

55 Richard McKim argues (McKim 94) that Democritus held all appearances to be true in a robuster sense of 'true' than that for which I argue here, viz. that 'they are all true in the sense that they are true to the *eidōla* or atomic films which cause them by streaming off the surfaces of sensible objects and striking our sense organs' (p. 286). Though McKim does not discuss what it is for appearances to be true to the *eidōla*, I take it that he is attributing to Democritus the account of the truth of appearances which Epicurus maintained, viz. that sense-impressions faithfully register the physical characteristics of the *eidōla* which impinge on the sense-organs. (For the evidence for and discussion of that theory see Taylor 96.) While I am in total sympathy with McKim's account of Democritus' overall epistemological strategy, I am unwilling to follow him in attribution of the Epicurean theory to Democritus, since none of our evidence gives any support to the suggestion that Democritus gave that or any particular account of the truth of appearances. I agree that he probably held that, for the reason dramatized in the complaint of the senses, all appearances had to be in some sense or other true if there was to be any knowledge at all. But against McKim I hold that we have insufficient evidence to attribute to Democritus any account of the sense in which appearances are true, beyond the implicit claim that all appearances are equipollent. It is plausible to suppose that Epicurus' account was devised in an attempt to make good that deficiency.

his epistemology. In every other area we are virtually wholly dependent on doxographical evidence. When we come to ethics, by contrast, the doxography is meagre (see **188–94**), but on the other hand we possess over two hundred purported quotations from Democritus on ethical topics. Here, however, the evidential situation is very different from that in the area of epistemology, since the great majority of those quotations are contained in two collections, those of Stobaeus and the so-called 'Sayings of Democrates' (*sic*), where they are presented in isolation from any context and without attribution to any specific work. As the authenticity of this material has given rise to considerable debate, it will be necessary to undertake a brief consideration of that question before proceeding to discuss the content of Democritus' ethical views.

Scepticism about the authenticity of the ethical fragments is grounded in two primary considerations, first the silence of Aristotle and Theophrastus on Democritus' ethical writings and secondly the fact that our sources for the bulk of the fragments, Stobaeus and 'Democrates,' cannot plausibly be thought to have been compiled from direct access to texts of Democritus. Stobaeus' anthology is clearly based on earlier collections which included, besides excerpts from extant texts of authors such as Plato and the tragedians, anecdotes and maxims attributed to such famous figures as Pythagoras and Socrates, which cannot have had their origin in works written by their supposed authors. Since Stobaeus never cites any Democritean title, but merely ascribes citations to Democritus by name, it is virtually certain that he found his material in a collection of such maxims. This is confirmed by the fact that thirty maxims are common to the 'Democrates' collection and that of Stobaeus. We may not, of course, conclude that the latter used the Democrates collection itself; it is more plausible to posit one or more collections of 'Democritean' material which were used by the compilers of the numerous anthologies (including those of Stobaeus and 'Democrates') containing maxims attributed to him. This is clearly an unpromising basis for claims to preserve the actual words of Democritus, and were we wholly dependent on the material preserved in these collections we should be forced to acknowledge that we could have no good grounds for confidence in the authenticity of any of the so-called fragments.

The situation is, not, however, quite as bad as that; we have some evidence, external to the collections, of maxims regarding the existence and content of the ethical works of Democritus, and some confirmation from other sources of the wording of a few of Stobaeus' quotations. The evidence of the existence of the ethical works serves to rebut the argument against the authenticity of the fragments from the silence of Aristotle and

Theophrastus. Diogenes' list of works (**40** (46)) establishes the existence in the time of Thrasyllus (first century AD) of texts of a number of writings of Democritus on ethics, including a work *On Cheerfulness* which Seneca appears to have read (**188c**). Cicero is familiar with Democritus' doctrine of the supreme good and with the terminology in which it was expressed (**188a–b**), though it is unclear whether he had read the original texts. The silence of Aristotle and Theophrastus must therefore have some other explanation than that Democritus did not write on ethics. As far as Aristotle is concerned, three points should be made. First, his ethical treatises mention the views of earlier writers, except Plato, very sparsely. Second, the extant works in which he discusses the atomists at length (principally *Physics*, *GC*, *De Caelo*, and *De Anima*) deal with other subjects. Third, he is reported to have written two works on Democritus, both lost (with the exception of the single passage preserved by Simplicius (**44a**)). For all we know, these works may have included some discussion of Democritus' ethics. As regards Theophrastus, Plutarch preserves evidence (**D34**) of his having responded to an ethical thesis of Democritus', indicating that he did not in fact pass over the latter's ethics in total silence. How systematic his discussion was we have no means of knowing.

A few of Stobaeus' maxims are also attributed to Democritus by earlier writers. **D24–5** occur in Stobaeus' lengthy excerpt from the history of ethics by the first century AD writer Arius Didymus (II.7), indicating at least that collections of Democritean material, and possibly complete works, were extant in that period. **D26** and **D28** are also cited by Clement, **D27** by Plutarch, and **D29** by Dionysius of Alexandria (quoted by Eusebius); Dionysius describes the maxim as occurring 'at the beginning of his [i.e., Democritus'] precepts,' indicating that he had read a collection of Democritean maxims, and we may recall the title *Ethical Notes* in Thrasyllus' catalogue (**40**.II.4). We can, then, be reasonably certain that ethical writings by Democritus existed in the library of Alexandria in the first century AD, and that the writers mentioned in this paragraph had access to them, either directly or via compilations of excerpts from them.

It is at the very least a reasonable conjecture that the Democritean sayings in Stobaeus and 'Democrates' derive ultimately from that source.[56] How

56 So Philippson 112, who maintains that all the 'Democrates' saying originate from an Alexandrian collection of authentic sayings of Democritus, the name 'Democrates' arising from manuscript corruption of 'Democritus.' Philippson's view is accepted by DK. Other scholars believe that in the Alexandrian period there existed, in addition to a collection of maxims of Democritus, another collection of sayings by a philosopher named Democrates (otherwise unknown), and that the two were conflated by a process of textual corruption

much of that material is from the hand of Democritus himself is much harder to determine. A number of Stobaeus' sayings contain vocabulary attested in the doxography as Democritean. *Euthumos, euthumia,* etc. (cheerful, cheerfulness) occur in **D27, D39, D53, D55, D122, D143,** and **D151,** *euestō* (well-being, cf. **189, 40.II.4**) in **D121,** *athambia* (freedom from fear, cf. **188b**) in **D79,** and the cognate adjective *athambos* in **D80** (the latter the only recorded occurrence of this word). **D39** also contains the only recorded occurrence of the noun *aterpeiē,* distress, an alternative form of *aterpia,* attested as Democritean by Clement (and Stobaeus) (**D26**). The 'Democrates' sayings, in contrast, contain no sign of Democritean technical vocabulary, with one possible (and possibly significant) exception, the occurrence of the word *skēnos* (literally tent or dwelling) in the sense 'body' in nos. 36 and 57. Though a comparatively rare word, it also occurs in three Stobaeus citations (**D87, D134,** and **D153**) and in a report by Aelian of some of Democritus' biological teachings (**145** (17) (not translated)), where it may well echo a use by Democritus himself. It is also attested in that sense in an inscription (*CIG* 3123) from Teos, the mother-city of Democritus' native city of Abdera, which suggests that it might reflect a local idiom. This connection might, of course, be purely coincidental, but other evidence connects some of Stobaeus' citations more firmly with Teos and Abdera. **D124** closely echoes the wording of an oath taken thrice annually by magistrates at Teos and Abdera, while **D116, D118, D127,** and **D143** also show traces of legal terminology associated with both cities.[57] **D121–4** are closely connected in subject-matter, setting out in legalistic terminology a list of immunities for the killing of various kinds of anti-social persons and (apparently) animals; as noted above, **D121** contains the Democritean term 'well-being' and **D122** 'cheerfulness,' thus linking this series (already linked to Teos via **D124**) with the others cited above as containing Democritean technical terms.

Taken as a whole, the collection of Stobaean and 'Democratean' material is stylistically unhomogeneous, but some patterns may be discerned within the material. With the single exception of 36 all the 'Democrates' sayings consist of a single sentence stating a practical maxim, sometimes (e.g., 37) with an antithetical structure. The vocabulary is uniformly prosaic, and (as noted above) the only trace of technical Democritean vocabulary is in the anomalous 36 (which is also cited, with a slight verbal variation, by Stobaeus (**D52**)). The opening maxim, which appears to be in effect a motto for the collection, recommends that one attend to the sayings 'with

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in the reverse direction, in which the unfamiliar name 'Democrates' was assimilated to the better-known 'Democritus.' For a helpful review of the issue see Flamand 100.

57 For details see Lewis 105.

intelligence' (*xun noōi*), and intelligence and unintelligence are keynotes throughout, mentioned in 52, 54, 58, 59, 64, 65, 66, 67, 75, 76, 77, 83, 95, 98, 105, and 113. A few state succinctly points spelled out more fully in Stobaeus. Thus Democrates 41 summarizes Stobaeus **D46**, Democrates 80 summarizes Stobaeus **D117**, and Democrates 84 summarizes Stobaeus **D108** and **D128**, while Democrates 88 states a point (the self-destructive character of envy) central to Stobaeus **D55**, **D101**, and **D109**. In addition to the thirty sayings common to the two collections, Stobaeus also contains a substantial number of similar 'one-liners,' including the group consisting of **D61**, **D63–6**, and **D68–70**, all beginning with the word *anoēmones*, 'the unwise,' a feature which links them to the Democratean theme of intelligence and unintelligence. On the other hand his collection also includes many longer excerpts, some of which display stylistic features absent from (or at least less prominent in) the Democratean maxims, a fondness for poetic and unusual words, a strongly antithetical style, and the more frequent use of Democritean technical vocabulary. Some of these features also appear in the shorter Stobaeus excerpts: thus **D94**, containing the two rare words *aneortastos* and *apandokeutos* (the latter not found elsewhere) is altogether 'un-Democratean' in style.

It does not seem to me possible to divide this material into the exclusive and exhaustive categories of 'genuine' and 'spurious' on grounds of style or content. Indeed, the hypothesis (which has considerable antecedent probability) that the ethical writings of Democritus underwent a continuous process of anthologizing and excerpting over a period of centuries puts those categories themselves into doubt. How much paraphrasing, abbreviation etc. must a passage undergo before it ceases to be 'genuine'? In this study I shall proceed on the following assumptions:

(i) A substantial amount of the Democritean material in Stobaeus derives from Democritus' own writings (for reasons supporting this assumption, see above);

(ii) We have grounds for greater confidence in the genuineness of a quotation from Stobaeus when that quotation is also ascribed to Democritus by a writer earlier than Stobaeus;

(iii) The 'Democrates' sayings, even if (as is likely) their ultimate source is the writings of Democritus, represent a stage of transmission of the tradition more distant from Democritus himself than that represented by those passages counted as genuine under clauses i and ii.

I have therefore counted as 'ethical fragments' of Democritus all passages occurring in Stobaeus *except* those common to Stobaeus and 'Democrates.' I have translated 'Democrates' separately, counting that material as evidence

for the transmission of the Democritean tradition in antiquity. I count it as evidence for the thought of Democritus only in cases where it is confirmed as Democritean by some other source. I have listed ethical fragments attested by writers other than Stobaeus (including fragments attested both by Stobaeus and another) separately from those attested by Stobaeus alone, to signal the problematic evidential status of the latter's collection.

Our evidence indicates that Democritus was concerned with both moral and political questions, and also with the connections between them: i.e., with how the individual should live, how the political community should be organized, and how the individual should contribute to that organization. It shows that he was engaged with the wide-ranging contemporary debates on individual and social ethics of which we have evidence from Plato and other sources. On what Socrates presents as the fundamental question in ethics, 'How should one live?' (*Gorgias* 500c, *Republic* 352d), Democritus is the earliest thinker reported as having explicitly posited a supreme good or goal, which he called 'cheerfulness' or 'well-being,' and which he appears to have identified with the untroubled enjoyment of life (**188–90**).[58] It is reasonable to suppose that he shared the presumption of the primacy of self-interest which is common both to the Platonic Socrates and to his immoralist opponents. The evidence of the testimonia and the fragments is that 'cheerfulness,' the ultimate human interest, was to be achieved by moderation, including moderation in the pursuit of pleasures (**D55, D74, D75, D78, D83, D86, D87, D88, D96, D97, D98, D99, D110, D147, D148, D150, D151**, Democrates 70), by discrimination of useful from harmful pleasures (**189, D53, D71**, Democrates 71, 74), and by conformity to conventional morality (**D39, D79, D81, D120**). The upshot is a recommendation to a life of moderate, enlightened hedonism, which has some affinities with the life recommended by Socrates (whether in his own person or as representing ordinary enlightened views is disputed) in Plato's *Protagoras*, and, more obviously, with the Epicurean ideal of which it was the forerunner (cf. **188d**).

An interesting feature of the fragments is the frequent stress on individual conscience. Some fragments stress the pleasures of a good conscience and the torments of a bad one (**D39, D79**) while others recommend that one should be motivated by one's internal sense of shame rather than by concern for the opinion of others (**D108, D128**, Democrates 84). This theme may well reflect the interest, discernible in contemporary debates, in what

58 For fuller discussion see Gosling and Taylor 101, ch. 2.1.

later came to be known as the question of the sanctions of morality. A recurrent theme in criticisms of conventional morality is that, since the enforcement of morality rests on conventions, someone who can escape conventional sanctions, e.g., by doing wrong in secret, has no reason to comply with moral demands. Thus Antiphon (DK 87 B44) contrasts the ineffectiveness of moral sanctions with the inevitability of harm for one who contravenes the natural norms which prompt one to seek one's own advantage, and the author of the Sisyphus fragment (DK 88 B25) attributes the origin of belief in the gods to the contrivance of a clever individual who aimed to deter wrongdoers by the pretence that, while they might evade human punishment, they could not escape the all-seeing gods. The most celebrated expression of this thought is Glaucon's tale of Gyges' ring in *Republic* II; someone with the gift of invisibility (like the legendary Gyges) would be a fool not to take advantage of the resulting ability to do wrong with impunity (359b–360d). A defender of conventional morality who, like Democritus and Plato, accepts the primacy of self-interest therefore faces the challenge of showing, in one way or another, that self-interest is best promoted by the observance of conventional moral precepts.

The appeal to divine sanctions,[59] cynically described in the Sisyphus fragment, represents one way of doing this, and there are some traces of this response in Democritus. We saw above that he accepted (contrary to the later view of Epicurus) that the gods are concerned with human affairs, and the statement of Pliny the Elder (**174**) that he believed in just two gods, Punishment and Reward, may be a garbled reminiscence of his having asserted that the gods reward and punish human agents. To be sure, his theory of the atomic, and hence mortal, nature of the soul allowed no possibility of post-mortem rewards and punishments, as **D149** and **D162** explicitly attest. But the theory allows for divine rewards and punishments in this life, and there is at least a hint of the former in **D81**.[60] **D40** suggests a complication: the gods bestow benefits on humans, but humans bring harm on themselves through their own folly. Is the thought that the gods do not inflict punishment arbitrarily, but humans bring it on themselves? Or is it rather that the form which divine punishments

59 For a more conventional treatment see *Republic* 363a–366a.

60 Democrates no. 80 in Orelli's numeration (marked as spurious by DK, printed by them between B112 and B113) refers to the efficacy as a sanction on conduct of the belief that the gods are watching over everything. This saying contains the phrase *oute lathrē oute phanerōs* ('neither in secret nor openly'), which also occurs in **D44**. It is not out of the question that the saying is genuine.

take is that of natural calamities, which humans fail to avoid through their own folly? The latter alternative would make the pangs of conscience one of the forms of divine punishment, while the former would see it as a further sanction. Either way (and the question is surely unanswerable) we have some evidence that Democritus was the earliest thinker to make the appeal to 'internal sanctions' central to his attempt to derive morality from self-interest, thus opening up a path followed by others including Butler and Mill.

The attempt, however pursued, to ground morality in self-interest involves the rejection of the antithesis between law or convention (*nomos*) and nature (*phusis*) which underlies much criticism of morality in the fifth and fourth centuries. For Antiphon, Callicles, Thrasymachus, and Glaucon, nature prompts one to seek one's own interest while law and convention seek, more or less successfully, to inhibit one from doing so. But if one's long-term interest is the attainment of a pleasant life, and if the natural consequences of wrongdoing, including ill health, insecurity, and the pangs of conscience, give one an unpleasant life, while the natural consequences of doing right give one a contrastingly pleasant life, then nature and convention point in the same direction, not in opposite directions as the critics of morality had alleged. (We have no evidence as to whether Democritus had considered the objections that conscience is a product of convention, and that exhorting people to develop their conscience assumes that it must be.) Though the texts contain no express mention of the *nomos-phusis* contrast itself, several of them refer to law in such a way as to suggest rejection of the antithesis. **D112** asserts that the aim of law is to benefit people, thus contradicting Glaucon's claim (*Republic* 358c3–6) that law constrains people contrary to their natural bent. **D112** is supplemented and explained by **D109**; laws interfere with people's living as they please only to stop them from harming one another, to which they are prompted by envy. So law frees people from the aggression of others, thus benefiting them by giving them the opportunity to follow the promptings of nature towards their own advantage. **D116** is the strongest expression of the integration of *nomos* and *phusis*; the city's being well run is the greatest good, if it is preserved everything is preserved, if it is destroyed everything is destroyed. A stable community, that is to say, is necessary for the attainment of that well-being which is nature's goal for us. This quotation encapsulates the central point in the defence of *nomos* (emphasized in Protagoras' myth (*Protagoras* 322a–323a) and the 'Anonymous Iamblichi' (DK 89 6–7)), that law and civilization are not contrary to nature, but required for human nature to flourish, a point also central to the Epicurean account of the

development of civilization (see especially Lucretius V).[61] The claim in **D46** that it is better to be persuaded not to do wrong than to be restrained by law is not inconsistent with this fundamental thesis; the fragment does not imply any contrast between law and nature, but between reasoned acceptance of norms and their imposition by fear of sanctions (cf. Democrates 41 'Abstain from wicked deeds not from fear, but because one ought not'). Persuasion will, in Democritus' view, presumably centre precisely on the message of **D109**, **D112**, and **D116**, that obedience to the law is in the interest of the individual.

There is little evidence in the fragments of Democritus' views on specifically political questions, such as the best form of political organization, and what there is is not wholly unambiguous. **D115** states a firm preference for democracy over tyranny, associating the former with freedom and the latter with slavery, but that falls short of the claim that democracy is as such the best kind of constitution. **D90** praises the value of free speech (*parrhēsia*), while characteristically adding a warning against exercising it at the wrong time. **D118** stresses the dangers of official positions being filled by *hoi kakoi*. While that may be merely an expression of the truism, compatible with any political system, that things go badly when unprincipled people hold power, it may have a more specific message of hostility to the admission to office of social inferiors consequent on the allocation of offices by lot, one of the features recognized as characteristic of democracy (Aristotle *Politics* 1294b8). **D131** 'Rule belongs by nature to the superior' is a paradigm oligarchic slogan, which is yet compatible with a moderate democracy in which office is elective. (On Democritus' assumption of elective magistracies, see below.)

Some fragments express an almost quietist attitude, stressing the dangers inherent in political activity: **D117** gives the depressing message that it is bad for one either to stick to one's own business without involvement in public life (for then one acquires a bad reputation), or to take part in community affairs, however honestly (for one is bound to make enemies). The dangers facing even the honest citizen in office seem to be the theme of the textually

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61 Another reminiscence of the *Protagoras* is provided by **D111**, whose cosmopolitan sentiment recalls Hippias' use of the *nomos-phusis* contrast to exalt the natural affinity of intellectuals over the artificial political boundaries which divide them (337c–e). I do not suggest that Plato was responding directly to Democritus (nor, as is not chronologically impossible, that Democritus was responding to Plato), but rather that they provide evidence of issues current in the later fifth and early fourth centuries. There is, of course, no inconsistency in maintaining both that law and society are necessary for the development of human nature and that some particular laws or conventions are contrary to nature.

corrupt **D130**. I read the ambiguous opening sentence as 'There is no way in the present organization of society not to do wrong to rulers, even if they are altogether good.'[62] This then appears to be explained by what follows, whose central theme is that as things stand the honest magistrate who has prosecuted wrongdoers while in office is liable to find himself under their authority once he demits office, and thus open to their vengeance. (Cf. **D27**'s warning against *polupragmosunē* in private or in public life.) Yet despite its dangers, active involvement in communal life is assumed to be necessary for communal and individual good. The office-holder must expect criticism if he does harm, while his doing good will be taken for granted, 'for he was not chosen in order to do harm, but to do good' (**D129**; note that it is assumed that magistracies are elective). But while good conduct in office may not win popular favour, it represents the highest form of personal goodness: 'He has the greatest share of justice and goodness who administers the greatest offices worthily' (**D127**). There is an obligation not to let criminals go unpunished (**D125–6**), despite the dangers inherent in enforcing the law (see **D130**): the series of immunities (**D121–4**) pronounced in favour of those who impose the death-penalty on wrongdoers is presumably designed to mitigate those dangers. The greatest good is the city's being well run (**D116**), which presupposes social concord (**D113–14**), which will be achieved if the wealthy feel concern for the poor and seek to help them (**D119**; cf. **D146** on the proper use of wealth as a public benefactor [*dēmōphelēs*]).

Overall, we may take it that Democritus held that the best form of government is a moderate democracy, in which magistracies are elective and citizens are encouraged to take an active interest in government and in the welfare of their fellow citizens. Abdera appears to have had a democratic constitution in his lifetime (see Lewis 105), and it is possible that he himself may have held office.[63] The main interest of his political fragments is not, however, in their contribution to political theory narrowly conceived (which

62 The sentence may also be translated 'There is no way in the present organization of society for rulers not to act wrongly, however good they may be.' The point of that even more pessimistic utterance might be that the honest ruler would be obliged to prosecute wrongdoers who had done him no personal harm, thus violating the principle of justice that one should not harm those who have done one no harm (cf. Antiphon POxy 1797 fr. A, col. 1, 10–35 (*CPF* I (1).17.2), included in DK as the concluding part of 87 B44). But that contradicts the concluding sentence of the fragment, which says that we should seek for ways to ensure that the person who has *done no wrong*, even in zealously prosecuting wrongdoers, does not become subject to them when he leaves office.

63 Some coins of Abdera dated (on the most recent dating) c. 414 BC bear the legend *epi dēmokritō*, 'in Democritus' term of office.' For details see Procopé 113b, pp. 309–10. It is of course not certain that the Democritus in question was the philosopher.

is modest), but in their relevance to the wider questions of the relations between individual and social goods and between *nomos* and *phusis* which are central to the ethical and social thought of the fifth and fourth centuries.

I conclude this section with a brief discussion of the vexed question of the connections (or lack of them) between Democritus' ethics and his physical theory. In an earlier discussion (Taylor 114, endorsed without further argument in Gosling and Taylor 101) I argued against Vlastos' claim (Vlastos 115) to find significant connections between the content of the two areas of Democritus' thought. Vlastos' position has found some recent defenders (and my views some critics), notably Sassi 69 and Farrar 99; these discussions seem to me to call for some re-examination of the question.

It is, I take it, common ground that in composing his ethical writings Democritus had not abandoned his physical theory, and therefore that, at the very least, he would have sought to include nothing in the former which was inconsistent with the latter. I shall make the stronger assumption that he took for granted in the ethical writings the atomistic view of the soul as a physical substance pervading the body. It follows that any state of the soul, such as cheerfulness, is a state of a physical substance, but it does not follow that any such state is describable in the terms of physical theory, and I see no evidence that Democritus thought that it was. There is no evidence which I have been able to discern that he attempted to derive any ethical conclusions (e.g., that the good is 'cheerfulness') from his physical theory, or that the physical theory provided any characterizations of the nature of any ethically significant psychological state. Let us take as an instance Vlastos' suggestion that the physical theory allows us to identify cheerfulness with the state of having one's soul-atoms in 'harmonious balance' or 'dynamic equilibrium' (115 [1945], p. 584). Now Democritus may well have believed that the soul-atoms of the cheerful person are harmoniously balanced, though there is no direct evidence of this in the fragments. But his theory provides no account of what it is for the soul-atoms to be harmoniously balanced other than this, that being harmoniously balanced is being in whatever state they are in when the person whose soul they constitute is in a state of cheerfulness. There is no independent characterization of harmonious balance such that we can say 'harmonious balance consists in one's soul-atoms having such and such physical properties, and it is a law of nature that whoever has his soul in that state is thereby in a state of cheerfulness.' Vlastos suggests (115 [1945], p. 581) that **D55** (DK 68 B191) provides such a characterization in its claim that 'excess and deficiency ... cause great changes in the soul. And souls which change over great intervals are neither stable nor cheerful,' but, as I argue in Taylor 114 (p. 13), it is

quite implausible, given the Democritean picture of the soul as a structure of particularly mobile atoms, to interpret 'change over great intervals' as a description of a state of physical motion.

There is, indeed, one particular point on which I now think that I took scepticism too far. This was in my rejection of Vlastos' interpretation of **D28** (DK 68 B33), that teaching creates a new nature by altering the configuration of the soul-atoms. My reason was that *ruthmos* was an atomistic technical term for the shape of an individual atom, not for the configuration of an atomic aggregate, for which their term was *diathigē* (see **45**). Hence *metaruthmizei* (or *metarusmoi*) in the fragment could not mean 'reshape' in the sense 'produce a new configuration.' But Vlastos had already pointed out that the catalogue of Democritean titles includes *Peri Ameipsirusmiōn* 'On Changes of Shape' (**40** (47)), which cannot refer to changes in the shapes of individual atoms (since they are unchangeable in respect of shape), and must therefore refer to changes in the shape of atomic aggregates. Further, Hesychius glosses *ameipsirusmein* as 'change the constitution [*sungkrisin*] or be transformed,' and though he does not attribute the word to any author it is at least likely to have been used in that sense by Democritus, since neither the verb nor its cognates are attested for anyone else. It therefore now seems to me that Vlastos' reading of the fragment is probably right. Teaching, like thought and perception, is for Democritus a physical process involving the impact of *eidōla* on the soul, with consequent rearrangement of the soul-aggregate. (Cf. the discussion of **D20** under 'Epistemology' above.) Acceptance of that causal picture does not, of course, commit one to endorsing the thesis that Democritus sought to derive ethical conclusions from his physical theory, or that he believed that there are law-like connections between physical and ethical descriptions.

Once those claims are abandoned, some looser connections between Democritus' ethics and other areas of his thought may perhaps be discerned. In Taylor 114 I argue for a structural parallel between ethics and epistemology, in that each area of thought requires a contrast between immediately apprehended data (immediate pleasure in the practical sphere, perceptual data in the theoretical) and the truth revealed by reflection, respectively the theses that the good is not immediate pleasure but long-term cheerfulness and that things are in reality not as they appear to the senses but as atomic theory shows them to be. That suggestion still strikes me as having some plausibility. Another vague connection is with cosmology. It is not unreasonable to suppose that Democritus saw at least an analogy between the formation of worlds (*kosmoi*) from the primitive atomic chaos by the aggregation of atoms under the force of necessity and the formation of communities (also termed *kosmoi*, **D122–3**) by individuals driven by

necessity to combine in order to survive, and it may be (as suggested e.g., by Müller 109) that the aggregation of like individuals to like, which is attested as operating in the formation of worlds (**77a** (31)), had some counterpart in the social sphere.

THE SAYINGS OF DEMOCRATES

[DK 68 B35–115]

Sayings preceded by an asterisk are judged spurious by DK.

35. Whoever attends to these sayings of mine with intelligence will do many things worthy of a good man and will not do many bad things.
36. Take account of the soul rather than the body. For perfection of the soul puts right the bad state of the dwelling [i.e., the body, the dwelling-place of the soul], but strength of the dwelling without thought does not make the soul any better. [Shorter version of **D52**]
37. He who chooses the goods of the soul chooses more divine things; he who chooses the goods of the body chooses human things.
38. It is a fine thing to prevent someone from doing wrong; but if not, not to take part in the wrongdoing.
39. One must either be good or imitate someone who is good.
40. People are blessed not in body or in wealth, but by uprightness and intelligent versatility.
41. Abstain from wicked deeds not from fear, but because one ought not. [Cf. **D46**.]
42. It is a great thing to think what one should amid misfortunes.
43. Repentance for shameful deeds saves one's life.
44. One should be a speaker of the truth, not someone with much to say. [Cf. **D89**.]
45. The wrongdoer is more wretched than the wronged.
46. It is greatness of soul to endure faults easily.
47. It is creditable to yield to the law, to the ruler, and to the wiser man.

48. The good man takes no account of the reproaches of the bad.
49. It is hard to be ruled by an inferior.
50. He who is altogether a slave to money would never be just.
51. Speech is often stronger in persuasion than gold.
52. He who reproves someone who thinks he is intelligent is wasting his time.
53. Many who have not acquired learning live according to learning.
53a. Many who do the most shameful things go in for the best learning.
54. The unintelligent learn prudence through misfortune.
55. One should strive for acts and deeds of virtue, not words.
56. Fine things are recognized and striven for by those who are naturally suited to them.
57. In animals good breeding is strength of the dwelling [cf. 36], but in people goodness of character.
58. The hopes of those who think correctly are attainable, but those of the unintelligent are impossible.
59. Neither skill nor wisdom is attainable if one does not learn.
60. It is better to criticize one's own faults than those of others.
61. Those whose character is properly ordered have their lives in order.
62. It is good, not to do no wrong, but not even to wish to.
63. A good reputation based on fine deeds is a fine thing; one based on bad deeds is the work of a fraudulent deceiver.
64. Many who have much learning have no intelligence.
65. One should cultivate much intelligence, not much learning.
66. It is better to plan before one's actions than to repent after.
67. Do not trust everyone, trust reputable people; the first is silly, the second prudent.
68. A man is reputable or disreputable on the strength not only of what he does, but also of what he wants.
69. To everyone the same thing is good and true; pleasant differs from one to another.
70. It is the mark of a child, not a man, to desire immoderately.
71. Inappropriate pleasures give rise to distress.
72. Violent desires for anything blind the soul to the other things.
73. It is righteous love to desire what is fine without wantonness.
74. Do not admit anything pleasant if it is not beneficial.
75. It is better for the unintelligent to be ruled than to rule.
76. The foolish are taught not by reason but by misfortune.
77. Reputation and wealth without intelligence are unsafe possessions.
78. Acquiring wealth is not a useless thing, but by wrongdoing is worse than anything.
79. It is bad to imitate the wicked, and not even to want to imitate the good.

80. It is shameful to take trouble about other people's business and neglect your own. [Cf. **D117**.]
81. Always putting off things makes one's actions incomplete.
82. People who do everything in word but nothing in deed are fraudulent hypocrites.

* Blessed is he who has wealth and intelligence; for he uses them well for what he should.

83. Ignorance of the better course is a cause of error.
84. He who does shameful things should first feel ashamed in his own eyes. [Cf. **D108, D128**.]
85. Someone who answers back and chatters a lot is unsuited to learning what he should.
86. It is overbearing to talk all the time, and never be willing to listen.
87. One must be on one's guard against the bad man, lest he seize his opportunity.
88. The envious man hurts himself as much as an enemy. [Cf. **D55, D101, D109**.]
89. One's enemy is not the man who does one wrong, but the man who wants to.
90. Enmity is much harder to endure from one's relatives than from strangers.
91. Do not be suspicious of everyone, but be cautious and safe.
92. One should receive favours with the intention of giving greater ones in return.
93. When you do a favour be careful that the recipient is not a deceiver who will return ill for good.
94. Small favours at the right time are the greatest for the recipient.
95. Honours have great weight in the case of sensible people, who understand that they are being honoured.
96. The person who does a favour is not the one who looks for a return, but the one who chooses to do good.
97. Many who seem to be friends are not, and many who do not seem to be are.
98. The friendship of one intelligent person is better than that of all the unintelligent.
99. He does not deserve to be alive, who has not one good friend.
100. He whose tried friends do not remain such for a long time is a difficult character.
101. Many turn their friends away when from prosperity they fall into poverty.
102. In everything what is equal is fine; excess and deficiency do not seem so to me. [Cf. **D55**.]
103. He who likes no one does not seem to me to be liked by anyone.
104. A wheedler who talks eloquently is [like] an old man with charm.
105. Beauty of body is animal-like,[1] if there is no intelligence behind it.

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1 Or, possibly, 'like a picture.' The Greek is *zōiōdes*, from *zōion*, which can mean either 'animal' or 'picture.' Cf. **D59**.

106. In good fortune it is easy to find a friend, but in ill fortune it is the most difficult of all things.
107. Not all one's relatives are one's friends, but those who agree about what is beneficial.
107a. As we are men, it is right that we should not laugh at the disasters of mankind, but grieve.
108. Good things come with difficulty to those who seek them, but evils even to those who do not seek them.
109. People who like to find fault are not adapted for friendship.
110. Let a woman not practise speech; for that is terrible. [Cf. **D138**.]
111. To be ruled by a woman is the worst insult for a man.
112. It is a mark of the divine mind always to be thinking of something fine.
* If one believes that the gods keep their eye on everything, one will not go wrong either in secret or openly.
113. People who praise the unintelligent do great harm.
114. It is better to be praised by another than by oneself.
115. If you do not recognize the praise, think that you are being flattered.
* The world is a stage, life an entrance: you came, you saw, you went away.
* The world is change, life is a notion.
* A little wisdom is more honourable than a reputation for great folly.

[The following passage reports a further saying of Democrates:

Democrates said that to live badly, and not with prudence and self-control and holiness, was not to live badly, but to be a long time in dying.
PORPHYRY *On Abstention from Animal Food* IV.21]

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DIO CHRYSOSTOM (Dio of Prusa) Orator and philosopher; 1st–2nd c. AD (L).

DIODORUS SICULUS Historian; 1st c. BC (L).

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DIONYSIUS OF HALICARNASSUS Historian and orator; 1st c. BC (L).

EPICURUS Philosopher, founder of Epicurean school; 4th–3rd c. BC. Ed. G. Arrighetti, *Epicuro, Opere* (with Italian trans.), Turin, 1960. English trans. of fr. 34.30 in LS vol. 1, p. 104.

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JUVENAL Roman satirist; 1st–2nd c. AD (L).

LACTANTIUS. Ecclesiastical writer; 3rd–4th c. AD. Ed. *CSEL* vols. 19 and 27.

LUCIAN Writer of dialogues; 2nd c. AD (L vol. 1).

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PHILOPONUS (John) Aristotelian commentator; 6th c. AD. Ed. *CAG* vols. 14–17.

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PHILOSTRATUS Biographer; 2nd–3rd c. AD (L).

PLINY (the Elder) Roman encyclopedist; 1st c. AD (L).

PLUTARCH Philosopher, historian, and essayist; 1st–2nd c. AD (L).

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PROCLUS Neoplatonist philosopher; 3rd c. AD. Commentary on *Cratylus* ed. G. Pasquali, Leipzig, 1908. Commentary on *Republic* ed. W. Kroll, Leipzig, 1899.

scholium (pl. scholia): a marginal note in an ancient manuscript; scholiast: a writer of scholia.

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VITRUVIUS Roman writer on architecture; 1st c. BC (L).

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